

THE CADILLAC-LA SALLE NAME IN THE USED CAR BUSINESS

You are quite safe, generally, in assuming that a merchant who sells goods which you know to be reliable and honest is reliable himself. Consequently, you can reasonably expect that all his goods are reliable and honest.

Since your Cadillac-La Salle dealer sells new automobiles—Cadillac and La Salle—which enjoy the respect and admiration of a vast number of people, you can rightly expect him to be trustworthy. And this is a fact. Cadillac-La Salle dealers stand high in the estimation of their fellow citizens.

Surely, then, it is reasonable to assume that this trustworthy dealer—your Cadillac-La Salle dealer—will sell trustworthy used cars. And this, too, is a fact which hundreds of buyers allover the country have proved for themselves.

For reputable new cars imply reputable, dealers; and reputable dealers just as certainly imply reputable used cars.

CADILLAC MOTOR CAR COMPAN

Division of General Motors Corporation
DETROIT, MICHIGAN OSHAWA, CANADA

WHAT IS NEW THIS MONTH

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How to Perpetuate Your Earning Power

By WALLACE AMES, Financial Editor

"GOOD news, Laura," announced Dwight Miller, coming home from the office early Wednesday, the night before Thanksgiving. "My salary will be increased to \$5,000 the first of the year. That makes the fifth year in succession that I have started the New Year with a boost in pay. If these raises keep coming with their accustomed regularity we'll soon be drawing more pay than we know how to spend."

Dwight Miller is a typical example of a young man, whose scale of earnings is on

the incline.

п

"Here's your commission statement for the year," said the sales manager to Grant Walsh. "It shows you a little overdrawn. Your drawing account amounts to \$8,000 and total commissions on sales, \$7,350. Do you think you can make this up next year, or had you better reduce your drawing account a little?"

Being bonest with himself, Grant Walsh felt none too sure he could do better during the coming year than the one just ended. He was past the 50-year mark. He wasn't able to work his territory as hard as he did a few years back.

Grant Walsh is a typical example of the man past moddle life, whose scale of carn-

ings is on the decline.

According to statistics the average man's earned income increases rather steadily until he reaches the peak of his carning power somewhere, my, between 48 and 57 years of age. Of course a statistical rule will not apply strictly to any particular individual. For a variety of reasons any one individual's earnings may fluctuate upward or downward from year to year. The proprietor of a business may continue to increase his income steadily up to the year of his retirement. But there is no disputing the fact that the average man's carning power is on the incline up to a certain point in his business life: and then starts on the decline.

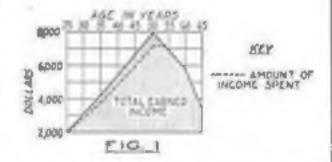
What could Grant Walsh do to stem the obbing tide of earning power? Very little, unless he had prepared for it during his earlier and more fruitful earning years.

What can Dwight Miller do now to prevent finding himself in Grant Walsh's predicament at some future time? The following example will show how he, or any man, can perpetuate his income,—have an investment income to fall back on when his earned income starts declining.

Assume that Mr. Average Man starts carring \$2,000 a year at age 25 and that

he does these things: (1) gets a \$250 yearly increase each year, up to age 50; (2) saves 10% of his income and invests it at the end of each year to earn 6%; (3) re-invests his interest, together with each year's savings; (4) when his earned income starts declining after age 50, that he uses enough of his investment income to replace the decline in his earned income.

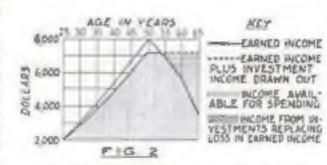
To work the case out completely let us assume that between ages 51 and 52 Mr. Average Man's earned income begins declining at the rate of \$250 a year, and after age 61 it drops \$500 a year. The following chart shows the rise and fall in his annual earned income between ages \$5 and 65.



Note the dash line. It represents the amount of earned income spent; the balance is invested and re-invested so as to earn the equivalent of 6% compounded annually. The most that Mr. Average Man has spent out of earned income in any year is \$7,200. Not until his earnings fall below \$7,200 does be begin to spend any part of his investment income. Even then he draws out only that amount of investment income which will bring his total spending up to \$7,200.

As a result of Mr. Average Man's easy investment program of 10% a year, he has sufficient independent income so that from age 50 on he can continue to spend \$7,200 a year, even though he carms less.

In the following chart again note the dash line, and the dark area representing investment income which replaces carned income.



The black area in the following chart shows the amount saved yearly; the dash line shows the cumulative total amount saved; the solid line shows the yearly gain in total worth, gained through interest on investments; and the dot-and-dash line shows the amount (Continued on page 5)



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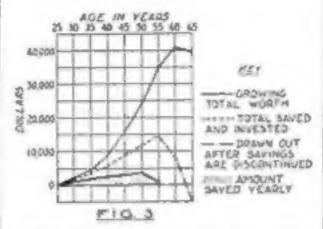
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How to Perpetuate Your Earning Power

(Continued from page 5)

of investment income spent after Mr. Average Man has ceased to save out of earnings.



Following is a summary of the mathematical results of this easy program,

Age Persoil	Amount	Completive Total faved		estment scome	Total Worth
26-30	\$1,250	\$ 1,250	-8	614	\$ 1,464
31-33	1,875	3,125	1	.057	4.182
30-40	2,500	3,623	- 9	,941	8,500
41-45	3,125	8,730	6	,429	15,179
46-50	3,730	12,300	18	,278	24,778
31-33	1,450	13,050	21	,119	35,000
Age Period	Ameunt S. Investmen	peat from at Lacouse		oftmatt.	Total Worth
56-00	8 4.	750	839	453	\$41,653
61-65	13,	500	44	256	39,956

Between ages 26 and 53, Mr. Average Man saves \$13,930; between 56 and 65 he draws out \$18,250 or \$4,300 more than total savings. As his savings earn \$44,256 he has \$39,956 left after spending \$4,500 more than he put in. (Continued on page 6)

A Service for Readers

THIS Financial Department is to help readers in the establishment of proper financial programs at the beginning of their business cureers; it assists those who have accumulated money in the proper investment of it.

The Editor of this Department is an authority on investment matters. He is ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Address your inquiries to Wallace Ames, Financial Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

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Name

How to Perpetuate Your Earning Power

(Continued from page 5)

At 6%, \$39,956 yields an annual income of \$2,307 on which to retire.

The most powerful forces in getting ahead are (1) regularity in savings and (2) re-investing interest so that it will compound itself. While \$800 was the greatest amount saved in any one year, Mr. Average Man's retirement income is \$2,397.

POPULAR SCIENCE MONTHLY suggests that every reader start the New Year with a program to save at least 10% of his earned income, on a re-investment hasis, so that he may perpetuate today's earning power through later years.

To Help You Get Ahead

THE Booklets listed below will belp every family to laying out a financial plan. They will be sent on request.

"How to Build on Independent Income" is the title of a new booklet by the F. H. Smith Company which explains conclusively how people of moderate means may obtain financial pensperity. "55 Years of Investment Service" describes the history of progress of the F. H. Smith Company as well as making an attractive suggestion in first mortgage real estate bonds. May be obtained by addressing the home office of The F. H. Smith Company, Smith Building, Washington, D. C.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bood & Mortgage Co., 1188 New York Life Building, Chicago, III.

"The Investment Trust from the Investor's Viewpoint," presents an explanation of this form of investment in easily understood terms, illustrated with some interesting examples of how the general investment trust will help the man with \$100 or more to get ahead. Published for free distribution by United States Fiscal Corporation, 50 Broadway, New York, Ask them for Booklet IT.

How to Retire in Fifteen Years is the story of a safe, sure and definite method of establishing an estate and building an independent income which will support you the rest of your life on the basis of your present living budget. Write for the booklet to Cochran & McCluer Company, 46 North Dearborn St., Chicago, III.

How to Get the Things You Want tells how you can an insurance as an active part of your program for gerting ahead financially. Phoenix Muroal Life Insurance Company, 328 Elsa Street, Hartford, Conn., will send you this booklet on

The Guaranteed Way to Financial Independence sells how a definite monthly savings plan will bring you financial independence. Write for this booklet to Investors Syndicate, 100 North Seventh Street, Minneapolis, Minn.

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Chinago, Illinois, July 12, 1928

Larus & Bro Co., 21st & Main St., Richmond, Va., Gentlemen

Replying to your excular letter of June 29, he informed that your mapple packages were received. With them I received the paughtet describing your product, which I was able to super reading because there was not in the circular matter the usual distanted a case talk which makes the conquent of a cample package feel obligated or unconfertable.

I believe your practice of giving your

I believe your practice of giving your prospect a sample and then letting him toaks up his own mind will gain you many more containers than will the usual modera calce practice of pushing the product down the prospect's throat. As a matter of fact, more receiving your sample and your advertising matter I smaked up the sample package and have since purchased a number of case from oeighborhood deal-

I have found Edgeworth to be a autho-factory blend at a very ressonable price. I look forward to a long membership in the Edgeworth Club.

Yours you truly,

Yours very truly, Jeff Corydon

Each year, it seems, more and more papelovers are enjoying the kindly feeling that exists among the members of the Edgeworth Club. Each year more men write in for emples and make up their minds about the flavor of Edgeworth.

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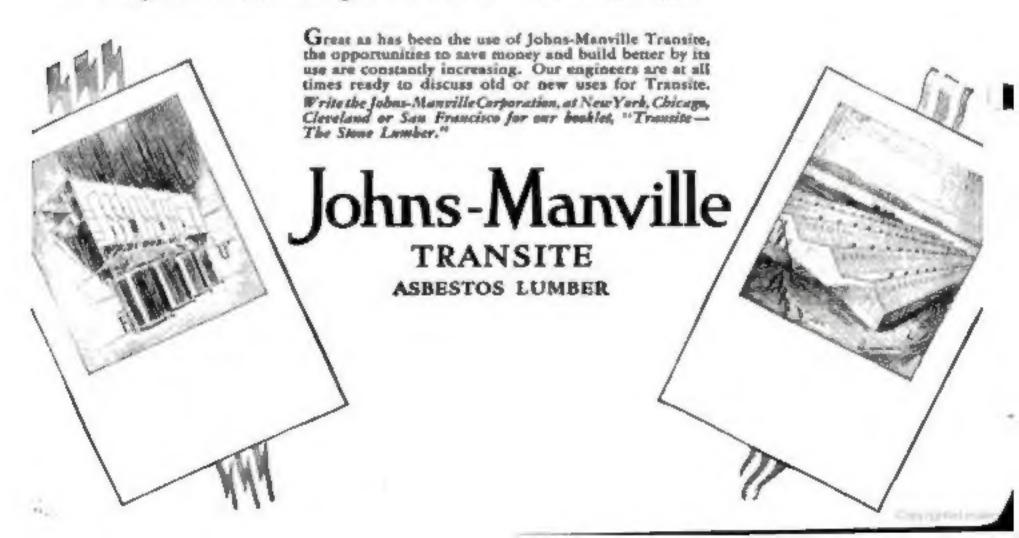
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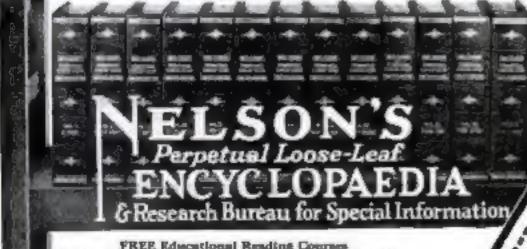
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CURELY, this could never happen to of the same desk be doing the same work - for ten straight years?"

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 For more than twenty years, till finally, at the age of 47, and still receiving only thirty dollars a week, R. M. Whitney resolved to be a bookkeeper no longer. He enrolled with LaSahe for training in Higher Accountancy. and completed the course. Almost immedi-ately came the offer of a bigger job.

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Present Peel tion

Address

Pulling the Magic Heat Switch

Features of Heating with Oil That Have Made So Many Home Owners Turn to This Ideal Modern Fuel

By

COLLINS P. BLISS, M.A.

Dierotor, Popular Science Institute of Standards

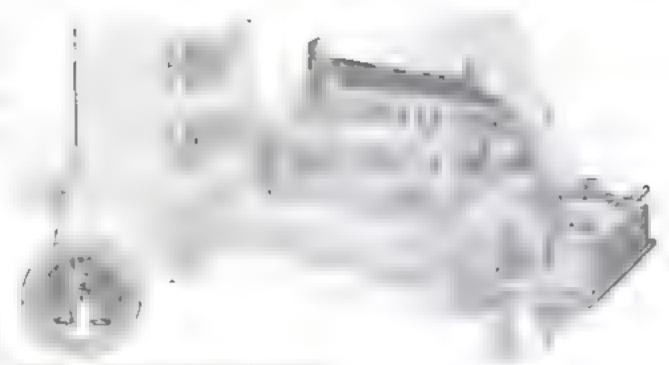
ND that's what decided me on oil heat." My friend had just finished describing an evening at a neighbor's home when the uncertain full temperature had taken a characteristically sudden drop. It is bost is method of restoring comfort had been to pull a switch and start the oil heating apparatus going. No shivering, no putting off the characteristic that of building a furnace fire—just the pulling of a switch was all that had to be done in that home to start the heating system for the season.

It is the automatic heating service which goes with all burners of the better type that has made so many home owners. switch to oil as fuel. Why tend a furnace, why shovel ashes, and why keep watching a thermometer and regulating house temperature when a good oil beating device will do it all? These are the features that appeal, and these are the features that make an investment in oil heating equipment a worth while one. An oil beater may or may not bring saving in fuel cost -and more probably not-but buying oil heating equipment involves something more than the purchase of a device which makes heat through use of another type of fael, it means the buyer is securing an automatic heating service, beardes.

EVERYONE who has an adequate heating system, electric supply, and lives in a locality where both the proper grade of oil and oil heating service are available, can take advantage of this modern methoil of heating. The change from coal to oil as firel does not involve particular difficulty or delay and can be made in winter

In this connection there is one point that should be stressed, bowever, and that is that an oil heater is no cure all for the alle of a poor heating system. No matter how effix ent the oil heating device it cannot make up for definencies in the heating system of which it forms a part. If that third story north room is hard to heat with coal, matters will not be improved much through the change to a different kind of fuel. An oil heater is pist the heat producing mechanism for the rest of the beating system, and that heating system has to be put in first-class operating condition before it can cooperate properly with a good oil burner.

But it is hard to equal the wonderful results that come from the proper installation of an efficient oil burner in a good



heating system. Chief of the benefits is the maintenance of house temperature within a two-degree variation from any set temperature from fall until spring, and without attention. Most of the better burners now on the market are fitted with automatic control equipment that regulates performance in a way no human being in constant attendance could ever do, for the human body will not recognize a difference of one degree or less.

TPHE control device not only provides an I even temperature and freedom from attendance, but also promotes the efficienev of the heating system. The oil burner operates only when necessary to keep the temperature at the desired level. If the outdoor temperature goes up, the control device sees to it that no more fact is used than is necessary to keep the house at the temperature the owner has designated. Truly a wonderful fire tender time device! One to such regulation, real saving in fuel is effected especially in changeable chmates and in fall and spring. In fact, such weather is real oil hurner weather, for it is then that oil beating equipment reaches its peak of convenience.

The automatic service feature of oil heating equipment makes it a particular boon in homes where formice attendance falls to the lot of the women members of the family during most of the day. And, again it is especially appreciated when, after a night or a week-end away from home, the owner comes back to a comfortable house with no burnt-out fire nor broken water pipes as payment for his absence. Also, it is the pleasure and privilege of the oil burner owner to wake up in a warm house. He may set a dual-temperature thermostat so that the house temperature is automatically lowered during the sleeping hours and increased in the morning. He can, by the turning of a knurled knob, establish temperatures at any point between 55° F. and 85° F. Or, he can maintain his house at one temperature from October until May.

As for care, the oil heater requires none and should get none from the home owner Just as your automobile requires some mechanical adjustment from time to time, so the oil heating device may need

the attention of the service man at rare intervals, but a good oil beater will not require as much attention in a five-year period as the average coal furnace gets in five winter days.

These then, are the reasons that my friend is preparing to put oil heat in his home, that his neighbor has already done so, and that a chain of homes from one coast to the other are provided with oil heating someone.

heating equipment

Readers of Poptular Science Monthly who are considering this method of beating can accure definite help from the Popular Science Institute of Standards. Best advice can be given when details are supplied regarding the following points:

(a) number of coons in house (b) type of beating system; (c) amount of coal burned annually; (d) electricity or gas available.

Building Problems

The Popular Science Institute has enlarged its activities to include a service to readers in connection with building problems. If you are building or contemplating building, we will gladly answer any questions on which you seek information.

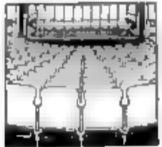
Insulation

One of the first activities of the Popular Science Institute has been the investigation of all facts regarding insulation. Over 2,500 building contractors and architects have supplied authoritative information on the question—all information available from all sources has been secured

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Each day new uses are being discovered for this remarkable product. Each day enthusiastic letters of praise are being received from a wide range of industries.

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DRUM SHELLS

radio boxes, paneling, closet lining and display booths, breakfast nooks and kitchen cabinets, signs and cut-outs of all kinds, suggest some of the many and varied uses of Presdwood.

Several railroads are now using Presdwood as paneling in their new Pullman cars. A box maker turned to Presdwood after a box of this material had withstood being dropped 1942 times when a similar box of conventional material failed after 871 drops. The Chicago Art Institute is using Presdwood as a backing to protect rare works of art. Campers' tables, safety wheels for bathing beaches, bread boxes, dust arresters for journal boxes and lining for elevator and ventilator shafts, suggest more of the seemingly endless uses of this grainless wood board.

Send for your sample

If discovering new and profitable applications for a product of unusual workability intrigues you, do not fail to write today for your free, generous sample of Presdwood. The chances are it will enable you to learn how to make a worthwhile improvement in some product.

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SEE your announcement of the forthcoming great series of articles on the Wright brothers, 'Fathers of Flight,' No doubt the author, Mr. McMahon-whose articles on housebuilding in your magazine I read dabgently—will boost Orville and Wabur clear up to the top floor of mamortal fame for their pervices to exclinations.

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"Twenty-five years ago Orville and Withur Wright put the first flying machine into the niz at kalty Hawk. Today every week-end ushers In a Bloody Bureau as the sky. Monday moreing papers recently told of eight deaths and eleven injuries in sirplane crashes in a day

"I ask you - isn't it wonderful? I trust that Mr. McMahon, in his own mimitable way. building a place for the Wright brothers in the Hu, of Pame, will not fail to mention all the great things these inventors have done for mank to especially in increasing the death S. T. R., Jr., Washington, D. C.

A Remarkable Flying Field



"IN IIIS article, "Cities In Race for Assports, Robert E. Marin mentioned Rockville Centre, a Lung Island village, as one community which recently dedicated a local acquirt I wonder if he happens to know what an unusual location this airport bus.

"It is on the bed of a huge reservoir that turned out to be a flivver. Years ago, city engrovers (I believe it was in Brooklyn, N. Y.) designed and built this reservoir as part of the esty water supply system. A great aval-shaped disc of earth was thrown up and faced with stone blocks to trap the waters of a stream. When the reservoir was completed they turned the water in. The mady buttom of the big bowl leaked like a nevel

"For years the reservoir and its works lay untauched, overgrown with trees and broad, a ghastly reminder of engineering stupicity. To the town boys it was known as the 'dry res.'

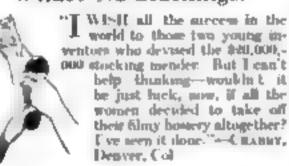
"And then someone had the hig idea. At airport! The leaky bed, when shoes of its overgrowth, offered a broad, level flying field. Acres of waste land at last found a use. Perhaps the example set by Rockville Centre may lead other communities to dedicate their waste land to American progress in the air "-D. S. B. Rockville Centre, N Y

What Is Your Reason?

"EVERY month I look forward to the day your magazine appears on the news stand I am well along in years, but I believe I still have 'divine currouty. Without that, a person becomes a parasite, fiving on the thinking of others instead of doing some of his own.

Your magazine, with all of its new ideas and inventions and suggestions, is the best food I know for original thinking. It stimulates the That's why I read Post Lan Scar sore Ad also to see letters from other readers telling why they read it."-O. B. B., Wanfield, Kans.

What! No Stockings?



What's Wanted

HAVE read your magazine for the last three years and found it to contain many valuable articles, but not enough chemotry Chemistry is a subject of importance in the undustrial system of Loday, and I think that a set of experiments that would illustrate ample chemical laws and reactions would be a valuable addition to your magazine." M. S., Kaukauna, Win,

Again you refer to the existence of a large book in your offices, made up of 'ouggested inventums from various of your readers. But what good does thus do all but a small numher of your readers, many of whom must be investively paramed, and so interested in such trange? By a don't you continue the practice of publishing, each month, excepts from U.a. G. M. Smit Lake City Utali

"Sailing On and On"

THE article entitled, 'What In Invention?' the writer failed to solve the problem. May this old retired teacher venture—in her lame way--- in give her viewpount?

"Invention is creation, humanly visualized, hut direct from the mind of the kimighty Creator. He pays out such knowlester to those filted to understand it, perhaps not fully but partly to those sufficiently in tune with Him to understand, perhaps, how to legin a new subject. One person is not always delegated to carry a thought to full completion, and others pick up the lines where left and sau on and on. F F L., Warrester, N)

Applied Mechanics



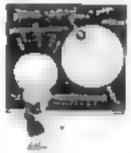
O! Rants-mono-rocket framil asked. Where in empty space will they get their resistance required to drave the rocket on? If he will go back to the second of Newton's laws, he can find the anower to his own question. This law states that the acceleration expenenced

by any given mass is proportional to the force apparet to that mass.

The gases ejected by the nomies of a rocket. come forth at a high rate of speed, relative to the racket. Since the internal force of the gases gives them their high velocity, this force has to act on something. The 'something is the front part of the explosion chamber. I sing this as a base, the gases push themselves out anto space. Here is where Newton's third law

of motion should be quoted. Since action and reacting are equal and opposite, if the gases push on the rocket, the maket pushes on them, and thus is kicked forward, '-W D. G., Jr., East Orange, N J.

Wouldn't It Have to Stop?



To THE question. If down straight through the earth, if much a thing were possile, and something deopped into it, would this wanthing dop andmay between 3 you gave the answer, 'Yes, it would.'

"I am melined to doubt

I'd answer that this. question as follows: 'Say a ball was dropped into this shaft. On approaching the center of the earth it would have its velocity increased. while the gravitational attraction for the ball would be decreased. At exactly the center of the earth there would be no gravitational at traction for the ball some this attnution is greatest at the earth's surface and dans of ea as we move inwardly), but the velocity goods. by the hall resuld earry at past the center

After passing the center, the half a velocity would be hustastee measure of the gravitatunul attraction pulling it back toward the center. When the opposite side was reached the ball's velocity would be zero and the gravitational attraction for it would be the greatest, so a duplication of this process would take place."- J. M. S., Framingham, Mass.

Step Right Up, Folks

TRE man with the largest bump of curiosity ever heard of in a accontact over here by the name of A. S. E. Ackerman. Addressing the world at large, he wants to know if there is any man slive who has ever dipped his hand mate molten lead and pulled it out again. His



reason, he man, is that he wants to settle the truth or fabrity of theories advanced by certain modern physicula that such a feat could be performed without injury

"Certain ancient recotda, it reems, tell of herors of old who bousted of plunging their hands

without scoreling them, borne present-day scientists claim that it might have been possible, due to mousture in the skin and other reasons. But I notice that some of them. Mr. Ackerman included, has volunteezed to try (t.

beeing that you Americans have the reputation of being tough skinned. I thought that some of you might step forward and help the gentleman out. - R. N., London, England.

Action in Colora

"WHETIFR you receive expressions of appreciation from subscribers for the very fitting color plates of your front cover I do not There is an up-to-dateness along the covers. They spett action, and Poppeau. Science stands for intest advances in action.

J. P. L., Worteesler, N. Y.



A Thordarson Power Amplifier (Home Constructed) Will Transform Your Radio Into a Real Musical Instrument

quality reproduction, power amplification has become a vital radio necessity. Today, it is hard to find a radio set manufacturer who does not employ one or more power tubes in the output stage of his receiver

There is no need, however, for you to ducard your present radio instrument in spite of the fact that it is out-classed by newer models with power amplification. You can build a Thordarson Power Amplifier which, attached to your receiver, will provide a fullness and richness of reproduction that will equal or surpass the finest offerings of the present season.

Thordarson Power Amplifiers are exceedingly easy to assemble, even for the man with no previous radio experience. Only the amplest tools are used. Specific instructions with clear-cut photographs, layouts and diagrams insure success in home construction.

Whether your present receiver is factory made or custom built one of these amplifiers may be attached with equal case. In fact, most Thordarson Amplifiers require absolutely no changes in the wiring of the receiver itself, attachment being made by means of a special plug which fits the last audio socket of the receiver.

Thordarion Power Amplifiers for the home constructor and professional set builder range from the simple plate supply unit up to the heavy-duty three stage units employing the 250 type power tube in push-pull arrangement. These power amplifiers cover the requirements for every purpose and every pocket-book. They may be used with any type of horn, cone or dynamic speaker

With a background of over thirty-three years manufacturing quality transformers, it is only natural that so many manufacturers of receiving sets of undisputed superiority have turned to Thordarion as the logical source of their audio and power supply transformers. The discriminating home constructor will do well to follow the lead of these manufacturers when buying his power amplifier.

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Celotex Insulation brings you new kome enjoyment and economy, undreamed of by other generations

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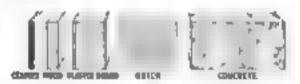
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JANUARY, 1929

SUMNER BLOSSOM Editor

VOL. 114, NO. I



Tomorrow we can see the sky roads crowded with planes - all born of the Wright brothers immorta, discovery,

At Last-The Inside Story of Wilbur and Orville Wright,

The Real Fathers of Flight

TUST twenty-five years ago the first frail airplane was launchedand, until now, the complete, intimate story of its creators never has been told It was Mr. McMahon's privilege to hear this story from Orville Wright humself, and to see private diaries, letters, and telegrams telling of the two brothers' dramatic struggles to fly. Here it is repeated to you -the most thrilling narrative of its kind ever published.

R. McMAHON

HE sky is place with winged craft. They dark through clouds and slade across the open blue. At night, unseen, they murmur their progress along storry pathways. They wend to distant cities. They expes the Atlantic and Pacific oceans, the continents of Asia and Africa, the North Pose and -soon -the South Pole. They make pictorial map surveys, patrol forests against fire. moneuver in military hosts, bring first aid to regions of disaster, poison insects in

field and orchard, carry machine parts to remote mines and this article to the printer, transport people and cash along with urgent letters.

Yet-think of it -a quarter century

ago no surplane existed?

Man flew for the first time on December 17, 1903, when Willbur and Orvide Wright, Americans, hunched themselves in the air at Kitty Hawk, North Carolina. They discovered the secret of flight, and their principles are embodied in every practical airplane known in the world today. They are the immortal pioneers who lifted man from the earth and gave him another dimension to move in with freedom surpassing that of the birds. The airplane has been improved but not essentially changed from the original "flying machine" devised by the brothers Wright.

These are facts accepted by a minority of informed persons. For the public at large the Wrights' title is under a cloud. Indeed many intelligent folk believe that Professor Langley of the Smithsoman Institution and a lot of clever Frenchmen collaborated to secure the conquest of the air. Langley's attempt at a flying vehicle is now on view in the Smithsonian at Washington, D. C., with a noncommittal label that credits it as the ancestor of aerial navigation, Because of that label, Ory lie Wright, last year, declined to exhibit the real proneer machine in our national museum at Washington and instend sent it to the friendly exile of the Science Museum in London. The English have been more hospitable to the Wrights than their own people—as represented by officials.

The public sees a mystery in the whole affair. It asks

"TF THE Wrights are the true inventors, why are their claims denied or whittled down by Government scientists? Why have clever Frenchmen and others obtained credence for partial paterrity of Daedalus' dream-cometrue? Why especially have the Wrights kept a relative wience for years instead of proclaining their ease from the hometope? Why have they not long ago taken the purite into their confidence, told their whole story, laid all their eneds upon the table for the unpartial judgment of mankind?"

I will give some short answers to these questions in advance of the foll explanations that will appear in the course of this narrative. First, I believe Government resentists are as human as anybody and those of the Smithsonian were very human in neeking to bask in the fancied glory of a colleague, the ill-fated Langley whose muchine crashed in the Potomac River a few days before the historic feat of the Wrights at Kitty Hawk

The scientists were glamly quiet for eleven years until the day when the Lang-

ley device, repaired, altered and new-engined, was

proved capable of an erratic hop over the waters of a lake Then they jubilated, and landed the late Secretary of the Smithsonusn as the Columbus of the sky disregarding the fact that his original machine emborked none of the John Onttileb Korreit. grandfather of the inventors. The foot-driven lathe in his curriage shop mede a leating intpresson on the minds

principles essential to practical flight. The late Dr. Walcott, ancessor to Langley as head of the Senthsonian, was chiefly responsible, in my judgment, for the ghostly revival of a museum chimera. Doubtless he was succee in the belief that an eminent scientist, his friend and colleague, had to be right as against a pair of young "hicycle men" of Dayton, Ohio, who never looked made a college door. Today the Smithsonian has a fairminded and conciliatory head—but the Langley legend and tradition are hard to put down at the national capital.

of the two little buys.

Prof. Langley does deserve our respectful homage in passing, for
he attempted what was
suid to be impossible,
and though be failed,
his faith stimulated oth
ers to success.

What of the elever

Frenchmen and others? They were all ciever adapters, if not outright filehem, of the invention proved at kitty Hawk. They were good at publicity and colorful feats and at commercializing. Some of them made real contributions to aviation and they added useful refinements, but none was able to dispense with the basic principles discovered by the Winghts or to alter the chief features of the original sky craft. There

may be loopholes in patents, but not in the laws of Nature that govern

Why have the Wrights kept a selection adendered a partial ocluse?

THEY were shy by nature and up-bring-ing, became reticent to protect an invention that many laughed at and tried to steal. They had no gift for publicity, shrank from clamor, feared and districted the prying press, came to

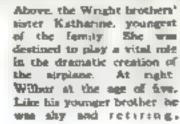
prying press, came to suspect a large part of their follow men. It was a natural reaction. They have an inclosed home life with an aging father and an only sister. They never married. They had no knack for business. They received a small fraction of the proceeds of an invention which yielded millions to others and has a world value almost incalculable.

Wilhur, the elder brother, died in 1919, It was a great shock to Orville, who has striven more then to write a full account of an epochal achievement, as much to obtain complete honor and justice for that beloved brother a memory as for his own vindeation. The task seems too much, it opens wounds, it involves the baring of family intimacion which to a super-sensitive character are involute.

I believe the American public has a right to view all the evidence that may



Orwide Wright at the age of five a regular buy Making fires was an early passed. Once he started a blaze against a fence but plater Kathurine tuttled. He still likes to see fire-





help to unveil the mastery of the airplane origin and en-Bule it to award due honor to the men of Dayton Homely detans are part of that evidence often an essential part. drapes of secrecy do not fit the captains and benefactors of mankind. It was my privilege to study the unpublished documents of the Wright brothers, their dasries, letters, and family records, as well as to talk at length with Orville, his Jather, and sister, while staymg for several weeks at their home in the Ohio city. If the pub-

he had the same privilege, it would share my conviction that the Wrights stand amid the first scientist-discoverers of all time.

I MET Orville Wright for the first time I years ago in the lobby of a New York hotel. He was a small figure, neatly dressed, wearing a derby hat. One noted that his feet and hands were small. He hisped a trifle in result of the one air crash of his career. If it where was low, his words pleasant but few, his manner offilly constrained. This man had burne the thunderous acclaim of multitudes in America and Europe, had been received by three kings, an emperor, and a president, yet in my inconsequential presence his eyes were east down and his fingers twisted and twindled a button on the front of his contil

On our train trip to his mid-western borne. Orville Wright thawed a bit in the Pullman smoking room—not because but in spite of tobacco, which he does not use. He chatted in his mild voice of the baseball score, weather, and farm crops. He began a long, quietly homorous tale of his brother W Bur's scouting trip to Kitty Hawk, almost shipweeded in a suithout and saved from starvation by a glass of jelly that thoughtful Sister Katharine had packed in his bag. The inventor passed in his parrative and searched his memory.

"Was it grape or currant pelly?"

He was bound to be exact in this detail as in every other part of the yarn. He chuckled a little as he happily recalled the kind of jelly that it was. Afterward I heard hen discuss with his father the precise color of a cat that

"Let me see," be murmured.

crossed the road at hygone time,
"Orville, it was a black cut,"
rambled old Bishop Wright.

"No, FATHER, I think it was gray with some white

With such a passion for the exact shades of truth in cats, jelly, and else (scientific, after all, and some important events in the Weight chronicle are dated by like seeming triviality), one



The Wright homestead in Dayton, O., where Orville was been and Willbur died. This modest frame dwelling was largely the birthplace of the nir plane. In the yard at left Wilbur sewed the magnifes the propert arterials.

may understand delay in the production of the airplane history by the airplane brother. The flying machine was created in four years, but twenty-one years have been too shoet to narrate its origin.

The guest in the fine new mansion on a hill overlooking Dayton was installed in the host's own room with both at the front of the house. Moreover, he was never permitted to follow or walk with the host through any doorway, but had to precede. Such old world or Southern courtesy almost caused the viotor in his turn to fiddle with his coat button."

IN CONTRAST to the stately, withal genuine, politeness of Orvilla was the cheerful accapility of Kuthurine and the amiable gruffness of the old Bishop. The household consisted only of this trio with "faithful Carrie" and husband to do all the work—servants treated as friends There was about one visitor in a week, nor did the Wrights go forth more frequently on errands social or recreative.

from the outside world. Editors and writers variely collect was no indocement. Perhaps be held the theory that time answers everything or that alence is a good reply. It is sister would be delegated to respond to a few missives from those considered to at and within the circle of friendship.

HE DROVE to his city office daily

I never have trouble with my car be explained one day because I never do anything to it. Tinkering a car makes fromble. It is from right at the factory to the first place. Better leave it alone. I ofly give mine gas and od. If does not use water."

Some time later a home typewriter balked at its task of copying letters and documents perturing to the barth of the surplane Orvite forget ting his administration on cars, essayed to

to ker the wayward machine. He toled at it with screw driver and piers for three quarters of an hour. He examined, explored, poked, and pushed with seminist intensity. Then he gave it up as a hopeless case. I laughed at the thought of the world's premier mechanic thwarted by a peaky little re-account device which a youthful repair man was after to adjust in the motories.

At his office workshop Orvite was then working, alone, on an automatic stalu over for aircraft. It was a small but complicated affair with pendulum, mercury in gravity flow, and electrical actuation. On a later visit to Davion I found the inventor just as interested in a subcine to drive a boat with an air peopeller—he was fixing it up for a vacation trip in Camara with his favorate nephew. Buster, and thought it would be fair. At his home he also showed me with some pride how be had rigged up furnace regulator chains through the floor of the living room, saving a walk to the cellar. (Continued on page 112)

Wright hought his hoys first turned

their thoughts to mechanical digit,



Half a Billion New Stars!



one of a new and ve of home we be reproduced the page east of the stack

Greatest Telescope, to Enlarge the Universe Eight Times, and Marvelous "Sky-Theater" Promise Untold Thrills in Astronomy

By EDWIN W. TEALE

N A California mountain top, a few years hence, there will take place one of the great adventures of all time. A man will look into the night sky and his gaze will penetrate beyond the most distant stars within the range of ordinary telescopes, past the lonely "pland universes revealed by the grant 100 inch Hooker instrument at Mt. Wilson Observatory, beyond the last confines of man's knowledge of the heavens, at least four homes farther than any man has ever seen before!

This has just been made possible by a cift of the International Education Board to the California Institute of Technology, at Pasadena, for the purpose of building a 200-inch reflector telescope, twice the size of the largest now in existence. This posister eye is expected to multiply many times the sphere of our observation of the heavens and may show in half a billion namelem stars that he outside the range of our best modern telescopes.

The delicate work of easting the fusedquartz disk for the great mirror, nearly seventeen feet across, will begin within a few months and the finished instrument is expected to be in use within three years. The magnitude of this undertaking can be appreciated when we are told that this mirror disk alone will weigh thirty tons—as much as fifteen good sized automobiles!

Heretofore the chief disadvantage of the reflector type telescope has been its netwinebest to changing temperatures. Even a slight change in the room temperature is sufficient to expand or contract the glam of the Mt. Wilson grant the infinitesimal fraction of an inch sufficient to distort the image of a heavenly body moder observation.

In the proposed super-telescope, this



Hooker instrument, the first thing that would surprise you probably would be the position of the eyepiece. Instead of being at the end, as in the familiar "spyglass." rt will be at the nde. To see a star, you would look at right angles to the cylinder of the instrument trained on the heavens. The buge, dish-shaped mirror will be situated at the lower end of the cylinder. It will catch rays of light from a distant star and concentrate them at a point near the

What the penetrating eye of the monster telescope will discover can only be conjectured. Mysteries are locked in almost every glittering pin point of light that marks the position of a star on a winter night. Take that unassuming little star that trails along behind Sinus, the brightest star in our heavens. It seemed to offer little interest until recently astronomers, with their sensitive instruments.

weighed it and discovered that it is the

fell into an overal large enough to

contain it!

In one spot in the sky, so small to our eyes that it would not make a visible speck on the face of the moon, a cluster, in the constellation Hercules, contains more stars than are visible to the naked eye in both the northern and southern hemispheres! Opposed to this is "the darkest place in the sky," a black, pearshaped spot (Continued on page 129)



Shoots His Racing Car at a Target

By MARCEL WALLENSTEIN

O. D. Segrave, of Great Britain, former champion in the lists for international speed supremacy, will fire his great golden car at a target on the sands of Daytona Beach. Florida, in a do-or-dic effort to regain the motor car speed record for himself and his country.

Sheathed in a yellow metal cartridge, with 900 horsepower under the bood, Segrave hopes to cover the flying mile at a speed of 240 miles an hour! Double the speed of the average commercial airplane!

The best motor brains in England have combined to make the 1929 attempt such an overwhelming success that it will be almost a superhuman feat to overcome it as the last British speed records were overthrown by American dravers. There is no doubt that Segrave was vastly disappointed when, after driving his thousappointed when, after driving his thou-



Maj. H. D. D. Segrave, former speed king who seeks to regain his crown in the new car

sand-horsepowered Sunbeam at 203.79 miles an hour on the Daytona sanda, his speed was exceeded by a fellow country-man, Captain Malcolm Campbell, in the Bluebird, which covered the flying independent over the same course at 206.98 miles an hour.

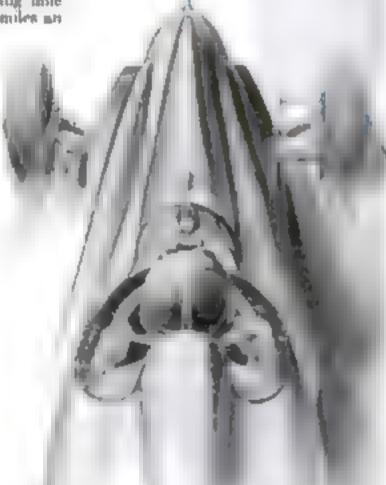
The entire British public was as greatly chagened when Campbell's record was torn down by an American. After his record was broken. Captain Campbell repeatedly made preparations for another attempt. He searched the Damah coast. in vain, for a stretch of said capable of affording as good a track as Daytona. He next announced be would make he attempt in the Mesopotamian desert but thus plan had to be alongdoned.

Meanwhile two London sportsmen offered to back Segrave in a second attempt at Daytona. The success of the British Supermanne scapiane S-5 in capturing the Schneider Cup at Venice last year suggested the type for Segrave's new car.

The two principal problems of speed on the ground are wind resistance and tire strength. It had been

proved that Naper could build an engine that would drive a vehicle at more than 300 miles an hour. It remained to provide the vehicle that would carry it against terrific wind pressure; and, also, presumatic tires strong enough to hold it on its road-burning course.

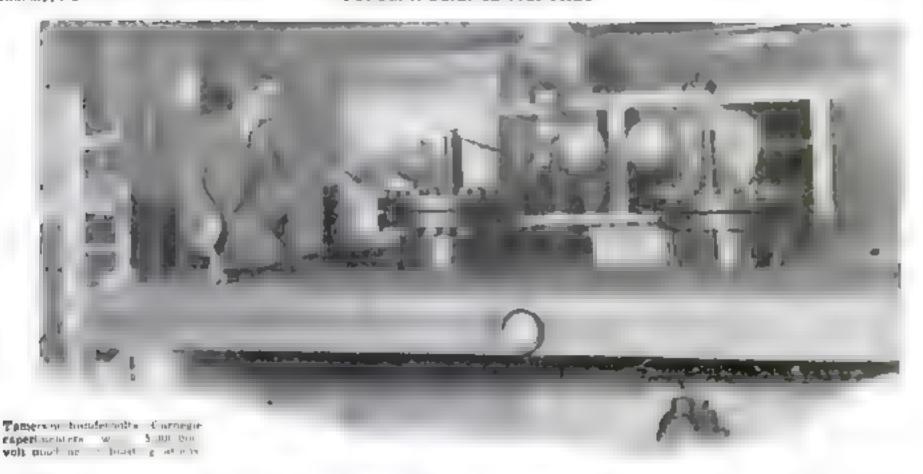
The matter of the car's construction was given over to J. S. Irving, the London motor engineer who turned out



Like a bester's tife, the car's hood is fitted with nights which Major Segrave will sim at the bull's-eye of the huge target.

Segrave's 1.000-horsepower Sunbeam With six draftsmen assisting, and detectives actually guarding their labors. Irving developed the Golden Bullet, as Segrave probably will christen his car

Irving went straight to the Supermarine seaplane S > for his ideas. If the victorious aircraft was correctly designed to win the blue ribbon of the air, why not the same (Continued on page 102)



Tills is a story of modern alchemists—of bold experimenters who have direct to imprison stupendous forces. Wielding 5,000,000 volts of electricity, they seek to blast the building blocks of the universe and fulfill the long-sought dream of "team-muting the elements." A thrilling adventure that will end—no one knows where!

LINDING streaks of flame sear the laboratory air. A crackle and sputter like a red-hot boder dropped in a water tank. For keed lightning writhes, twists, darts from two great bulls atop a ten-foot metal cylinder. Five matter voltaire on a rampage—the most stependous force ever wielded by the hand of man?

The occasion is the trying out at the Carnegie Institution's laboratory, in Washington, D. C., of a monster electric machine designed and recently completed by Dr. G. Breit and Dr. A. M. Tuve. Its purpose is to manufacture electricity—artificial lightning—of a greater voltage than has ever been generated before in a laboratory. By doing so, it paves the way for researches that may have startling and revolutionary consequences.

When the apparatus is operated, vustors stand at a distance and, though it is broad daylight, watch the room shot fit-

fully with the dazzling unreal re lunice of a thousand are lights. They are witnessing burnau he agaout-loveing the mythical master of the thunderbolts bunsed. Here is lightning tained caged, for mer to play with This 5 000 000volt machine the Carnege Institot on scientists have built to tear apart the innermost part des of fant for substances like iron and gold. With its stupendous power they are to attempt a feat abandoned as imposable 500 years earlier and only lately rendentited to scientific consideration the transmutation of

A Five-Million-Volt Gun Built to Smash Atoms

ALDEN P. ARMAGNAC

By

Above Tests coil of the type used in general ng the high voltages. The incobbed has of heat resulting glass. In wound with 8,000 turns of alls covered supper way.

Right Tremendous corner relessed to a magnificent display. Here is the Testa con sparking at about 200,000 volts, sending Sasket of man-coude lightness.

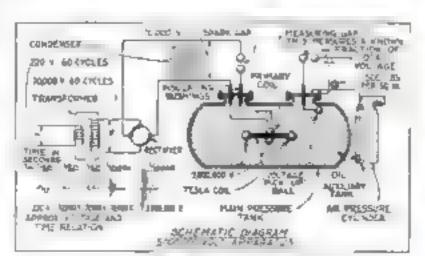
the elements, the changing, my, of such supposedly maintable things as aliver and lead into gold and iron.

t atil Sir Ernest Rutherford, in England, began bombarding atoms with radium a few years ago, the most powerful forces that science could bring to bear had failed interly to dept their internal structure. The electric furnace's terrific heat, blinding discharges of electricity as

powerful at were then available, chemical explosions, and the inconceivable coul of aquid are, were tried in vain. It was Ratherful who conceived the british plan of using the flying particles that speed like bullets from a grain of radium to knock atoms to pieces.

And, at least on a laboratory scale, he succeeded! He was the first modern alchemist, for he actually turned small quantities of aluminum, phosphorous, and other supposedly to mangrable elements into hydroge

Modern scientists believe trust



Showing design of the 5,000,000-volt apparatos at top of page.

the atoms of every element in our list of the ninety odd selstances from which all though are made are built of two differ ent kinds of particles and "protons" and "electron An atom of hydrogen, lighted known element, has one of each Helaum, the next beavier, bousts four apiece, and so on. Thus modern acience has arrived at the remarkable conclusion that what a substance will be depends solely upon how many protons. and electrons, or electrified particles, the atom contains in plan English, bow beavy it is

CI PPOSE we could give an atom of iron, say, a "reducing treatment" and knock off, not a few pounds. but a weight so small that we can count it only in protons and electrons. The new atom won't be iron any more! It may be manganese, chromium, variadium — or almost mny lighter element, depending on where the reducing treatment ptops.

Nor do the possibilities stop there. Perhaps if we could com-

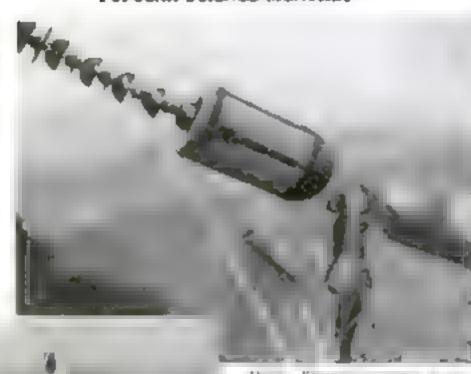
mand su table forces, we could make atoms "put on weight," too—build them up into heavier substances, as silver to gold.

When the Carnegie experts began the construction of their giant apparatus, there were only a few high-voltage electric laboratories in existence. At the General Electric Company's laboratories in Pittsfield, Mam,, cracking actificial lightning of \$.000,000 valts had been produced. The California Institute of Technology bas an outlit with a capacity of a million and a half volts, and Stanford University has a test set that can beast a radion Two or three metallations in Europe are of equal capacity

BUT Dr. Breit and Dr. Tuve, the Cartransformer that would step up ordinary electric current to bitherto unconcerved voltages. For design they chose a type of high-frequency transformer widely known as the Tesia coil -a device demonstraalmost forty years ago by Nikola Tesla

whose remarkable electrical inventions were recently described in this magazine. Code of this type in every high school today amaze the unmittated by flaming sparks of thousands of volts, as much as a foot long, which, bowever, because of their rapid vibrations, pass harmleasly through a person's body

The Carnegie experimenters built such a coil—a curious threefoot long, three-unch thick, mobbed parof best-resisting glass, wound with 8,000 turns of sikwound copper wire, surrounded by a small spiral of copper tubing. When a great condenser, or stor-



8-F -FT'4 Sw y A w TAP E F A THE DIX THE DISE The Community Community of the 13 ool spark our age attended spare

was discharged

through this spired, a miniature bolt of lightning surged through the tight-wound copper wire. Great sparks and streamers, and electrical leakage over all parts of the col, kept the measured voltage from mang above 300,000 or 400,000 volts. That was not high enough.

They musered the dumb-bell shaped Tesla cod in a great tank filled with oil. And at once the leakage teased. Up to three million volts rose the pressure in the coil before sparks from the caps on the ends of the coal would flush out into the

Then they played their trump card. They closed the tank, attached a pump, and proceeded to compress the oil to the terrific pressure of 500 pounds to the square outh. Stand the Woolworth Building in the ocean right side up, with its lower just at the water's surface, and the sea pressure at the ground floor would

nate the, filled with electricity at these No. 1 may a bigh voltame I ransformer and a Profiler for a se et engigely and get the dinary X-ray tube

Apparetus developed at the Carangie Institution in the search for a vacuum tube capable of applying 5,000 900 rosts in the etom. So for 1,000,000 volts to the greatest a tube can stand,

still be less than that in the

Then two metal balls atop the right-hand end of the tank, which by the length of the spark that leaps between them measure a known fraction of the total voltage, burst into electric flame. They were registering a current of more than 5,000,000 volts!

BY SLIGHT changes in the design of the cost," Dr. Tuve says, "even highor voltages can be obtained when they are desired." So for the highest of all bus been 4,200,000.

Thus colossal voltage the Carnegie experts are preparing to launch) upon stoms of familiar substances, to see what will happen. It remains only to perfect a vacuum tube figuratively, the mussle of this giant stege gun-expable of apply-

ng it. Though no tube to date has been devised that will remit puncture or short must by such a termendous lightning bolt, the invention of one seems near.

We have been able to operate one of are the sea at more than 1,000,000 volts for a short time," Dr. Tuve says, Dr. Coolidge, of the General Electric Company, he adds, has perfected a "cathode ray " tube that works at 900,000 volts and will probably go higher. Within the last few months Drs. Lauritsen and Bennett. of the California Institute of Technology, have made one which has operated several times at a million volts; and so the quest continues, with promuse of success just around the corner.

WHAT will at mean to science and industry when, through such tubes, five mulion volte or more is turned loose? The scientists' concern, of course, is to see what will happen to familiar substances, placed within these vacuum tubes whether they will turn into new aubstances before their eyes. But several other things may happen, of tremendous practical consequences.

For example, such tubes would produce X-rays more intensely penetrating than any ever before imagined. X-ray pretures could be taken through a whole -ding. Others could show flaws in tings many feet thick, as compared with the present effective range of only a

few inches. Not alone in industry. but in the actence of medicine and health the new super-voltage tubes might have supreme unportunce. The effect of such high voltage applied to a human being is oftenly impossible to predict,

Nor are the Carnegie Institution experts the only ones engaged in the quest. In a little steelsheathed lightning-proof cabin near the summit of Mt. Generoso, a 6.000 foot peak near Lugano. in the Swass Alps, three bold Germans are making ready one of the most daring experiments in the bistory of mankind. They pro-

Continued on page 148)

The Tallest by Fifteen Stories

what will be forward a sure factor of the strong that the transfer Mark to the sure of the strong two to the strong two to be strong to the strong two to be strong to the strong to the strong two to be strong to the strong to

A parton where the shift has not be street and the street and the street and the street and the street are street and the street are street as the

Place are suspected to the tree to the Control of the color words would take to ten stores above the Whispertal day a New York City when are tall an an

The stir me threating balances of the same garage where where will jurk the case The rawing bases these how each actor one bis come as a tradition on particular

The compartment rest upon one another a waste which they are raises and lowered by passes

Our artist per area here the remain of a few companies of the period of the completed of the six age.



Armored Ships Win Thrilling Battles with Polar Ice

Flirting Daily with Death, They Smash through Frozen Barriers to Vanquish the Earth's Farthest Strongholds

By ROBERT E. MARTIN

South Pacific, Commander Richard E. Byrd and his party of fifty-five adventurous men have finished the first lap of their two-year Antarctic expedition aboard the ice-breaking whater C. A. Larsen, largest this of its lend in the world.

To that hulking, awkwardlooking giant, battered and
toen but never conquered in
a hundred battles with the
frozen seas, the explorers
entrusted their lives, their
precions equipment, and
their high hopes for success
when they started out from
Los Angeles last autumn.

Commander Byrd chose the C. A. Larsen for his expedition because of its powerful build and its record as an ice-fighter. The type of vessel familiar to the average ocean traveler would be of no more use in making a voyage through eternal ice than a perambulator would be in an attempt to cross a desert.

Just a few days before the departure of the Byrd expedition, first reports reached this country of the stirring adventures of the Russian ice-breaker Malygia, which

penetrated the fey wastes of the Far North last summer with its aster-ship, the Krassin, to rescue General Umberto Nobile and his crew of the aniship Italia. Later it pursued a vain search for Roald Amundsen, the Norwegian polar explorer, who lost his life attempting to save those of the Italians,

ABOUT the same time, too, the U.S. Coast Guard patrol boot Moreon returned from a two-months' expedition to the waters between Labrador and Greenland, during which an oceanographic survey yielded a wealth of important findings, among them the fact that the Arctic chante, temporarily at least, is getting milder and may continue to lose some of its rigors.

All these events served to focus attention on the obscure but before part played in scientific exploration, navigation, and

If YOU have ever known the thrill of adventure, the battle against odds in the uncharted places of the world, you'll find this article of absorbing interest. No fiction can compare in moving incident with this modern suga of the great white North. It is a story of heroes who risk all to conquer the frozen seas.



Bresking ship lines through the set locked part of Helm glora. Finand. Right. The Russian rebreaker Arana in funed for its heroic part in rescuing the crew of the last dirigible Italia.

pathmakers through frozen waters. Without the restract expeditions such as that of Commander Byrd would be impossible. Nobile and his men would have periabed; the Poles never would have been decovered, and the year's season of navigation, as well as the extent of shipping routes, would be considerably curtailed.

The United States has see-breakers in service on the Great Lakes, along the

coasts, and on inland waterways to keep the lanes of navigation open. The cutters of the Coast Guard ply the North Atlantic, where they locate icebergs and warn mariners of the movements of these floating mountains. Every so often, as in the recent case of the Marion, they are used for study and survey

Through its rescue of Nobile and his men, the Krawen, a Rossian iceeutter, won world-wide fame overnight. But the name of its anter steamer was not even known until the story of the Malygon s hardships was brought to America through the Soviet I man Information Bureau in Washregton, D.C. Then if transpired that the valpart vessel, too, covered itself with glory on a trip filled with peols and thrills.

WHILE most of us, in sweltering heat, were perparing for Fourth of July celebrations, the Malysen was ice-bound several times and went through two termic stories, during

one of which it harrowly escaped shipwreek on Hope Island. A rock island in the Arctic never before varied. Time and again the bewildering fog of the Far North threatened to engalf the ship and its erew.

With a Junkers plane and pilot,



M. Bahushkin, aboard, the Mulygin act out on its rescue mission from Archangel, When it returned to port, the boat was battered almost beyond recognition, and the aviator had made fifteen flights over



Uncle Barn's ice-fighters, old and new. The larger picture shows the veteran wonden Court Quard rutter Saar, which for thirty nine years served as policeman, heapital, and food supply base in Aluskan waters. Bhe is succeeded by the steel cutter Northland, seen in top picture.

the ice and once had been lost for five days. On each of his type, Babushkin had to resnet to the dangerous expedient of taking off from the see and landing on it. again. At one of his perilous hop-offs, the piint had to shoot a polar bear that tried to camb one of his wanga!

In the beginning, all went well enough The Mulygon pushed a path through a

penusalal, pemafranen rubstance resembhag porradge. But soon, as Court in Cheeting by set epoch in at way northward course, huge fire appeared, rumbling against the above sees and hitting the timbers with thana ring crushes.

grant begy now and then the Matsum stuck, bucked water,

and plunged with all its might against the floes. At such times, the whole ship shook and its brains grouned in protest. The men aboard began to wonder whether the boot would ever make Hope Island, its first objective and to fear lest somewhere ahead of them the crew of the Holsa might be dying.

thable at last to smash through a

Recording water temperature from the Marion.

wall of see four and a half feet thick, the resiel came to a full stop,

It was midnight. The ship was thirty miles from the island. Three hours later another attempt was made to break through. By dint of herculean labor, the re-breaker battered her way for seven miles in four hours!

THEN the weather cleared a bit, Hope Island was aighted, a black granate mass. But the route to rescue lay beyond the island, around it and to the north. Foyn Island, where radio dispatches had reported the camp of the Italia e crew, was situated nearly in netyfour miles from King Charles Land,

porth of Hope Island.

For two days more the Malggin lought the impresoning ice in vain. Then it was decided to send out the plane. Bahushkin, accompanied by a meclanic, a hydrographer, and a radio operator, took off from a bashly constructed scaffolding. But fog suddenly swooped upon both ship and airplane. Babushkin, then thirty miles from King Charles Land. returned. Shortly after the aviators were back on board, a radio report was received telling that Amundsen was lost.

At midnight of the following day the plane took off again on what was expeeted to prove a ex-bour flight. But fourteen hours of anxious waiting followed! In that time, fog twice completely enveloped the ship. Then the plane returned. The aviators were safe. They had reached hing Charles Land and, after frightening off three pour bears, had eached gasoline caus and painted the red flag of the Soviet,

A couple of days later, motors having been overhauled, Babushkin started on a direct flight to Foyn Istand. An hour after he took off, radio contact between the plane and the ree-breaker was broken,

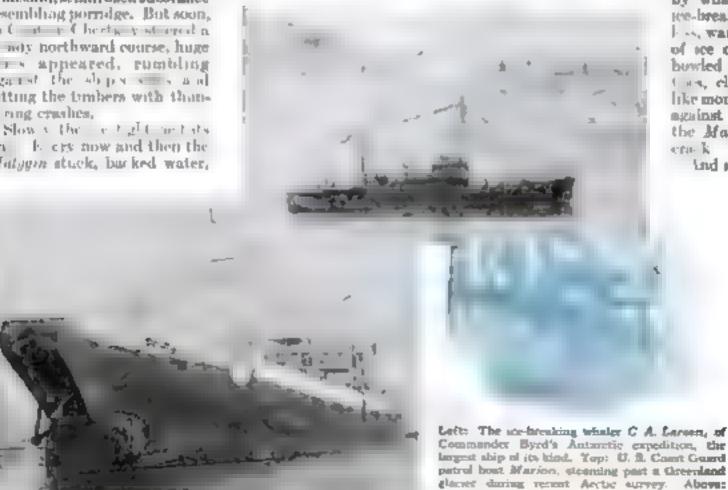
I RING the five days that followed. when no word from the plane was received, the Malygin, jammed in by the see, escaped shipwreck on Hope Island.

> by what accmed a miracle. The see-breaker lay helpless, motions, waiting. Slowly countless torus of see crowded closer. The wind bowled in the rigging. Enormous tas, charling higher and higher like monstrous white beasts, ground against the greening ship. Inside, the Malygia's partitions began to era-k

and always the pitiless, blinding glare of endless Arctic snow under the midnight min. A great ice field approached a n d splintered the hull. Another one, still beavier. The ship was tied up with huge hawsers to Abchors of ice; made fast to a gigantic floc.

Meanwhile, the radio operator stuck to his post. Every ten min-utes be sent the call, "Malyon, airplane. where are you' No answer. He removed a message from Moscow, "Seek Amundsen to

(Continued on page 155,



What the World Owes to 1928

Leaders in Many Fields of Applied Science Tell of the Year's Most Valuable Contributions to Progress



AVIATION

ALEXANDER KLEMIN, Sc. M. Professor of Association, Main York University



IN AIRPLANE design, perhaps the most striking advance has been in the crusing speed of commercial planes, particularly of the transport type Crusing speeds of 110 miles an hour were considered sat spectury.

two years ago. Now the operators demand 130 miles an hour. The advance is due mainly to refinement of streamline. The commercial airplane began to look more and more like a racer.

In airplane safety, a agmifeant step is increased experimentation with the leading edge slot, perhaps the greatest safeguard against the much decaded spinning

In the power plant the outstanding event of the year is the fight test by the Packard Motor Compeny of an aircooled radial Diesel engine, weighing only three pounds per horsepower. The greater economy of the Diesel means a far greater range for the airpoint and the use of heavy fuel in the Diesel is the greatest protection against free

Interest in the autogree has been revived by its flight from London to Para-

There has been a tremersions revival of interest in airships. Though the ocean crossing of the *Graf Zeppelis* was checkered, many authorities regard the airship as the only craft for trans-Atlantic travel

It is gratifying to see the enormous extension of American Air transport.



COMMUNICATION

R. W. KING, PH.D.



PERHAPS the most outstanding event of 1928 in the communications art was the joint meeting of some 1.000 engineers in New York and 500 electrical engineers in London, the trans-Atlantic telephone tying the two

groups together atmost as though they had been in one auditorium. During its second year, trans-Atlantic telephone traffic has grown rapidly and the first aupplementary short-wave channel to carry the rising load was opened.

Developments of previous years are finding expression in the continued growth of the telephone cable network connecting important cities, about 4,000 miles having been constructed during the year. Carrier types of telephone and telegraph circuits are assuming great importance and during the year a new carrier telephone system designed for lines from lifty to 400 miles in length was widely installed.

In the entertainment field, the telephone companies have made new advances in the adaptation of circuits for tying broadcasting stations together. The new art of tallong motion pictores, which hold fair to create as great popular interest as broadcasting did, uses acoustical apparatus that has arrien within the communication art. Scarcely less spectacular may finally be mentioned the sending of television images by auntight.



ENGINEERING

By F. W. PREE, JR.



White have when the most important advances in electricity and electrical engineering. To answer in a few words is difficult, so bound up with almost every phase of human activity has the subject become.

Among the accomplishments of electrical engagers in the past year must be included the remarkable advances which have brought. much nearer the day of practical television, a joint meeting of electrical engineers in London and New York by radio telephone, the televex for automatically controlling electrical equipment, the application of vacuum tubes to many new fields, the development of the 900 000. volt cathode-ray tube, the solution of stability problems of long-distance highvoltage transposion, the 50,000,000cycle take with ten-folowatt output. photo-electric tubes of greatly increased separativity, perfection of the radio beacon for guiding avsators, and the establishment of the study of lightning on a truly engineering basis.

Commercial installations of highly

efficient hydrogen-cooled rotating equipment, generating stations designed for turbines using 1,300 pounds steam pressure, decided advances in electric welding, further fields invaded by electric heating, new speed and efficiency records by electric slops — these and many more advances must also be included.



C. E. K. MEER, D.Sc.
Beccome Reward Letherstory, Rostman Kidah
Company



THE tendences on photographic progress shown in 1927 have developed further during the past year,

Paint bromater film sensitive to all colors has almost depasted the old noncolor sensitive the for the produc-

tom of theatrend motion pictures. Heversible panels countie film for the amalear move makes has also a pearen on the market and it rapidly consent the favor.

In the field of standard motion picture production, by far the most important most with the first tensoration is the introduction of scand records. These are at present water by several different methods and the procedure is by no means standardized, but it is evident that the recording of mound will play an important part in motion picture technique in the fature.

The greatest sensation of the year was the announcement of a perfected process by which amateur contractors process make films in natural coor instead of in monochrome. The process involves only the addition of color filters to the camera and projector and the employment of a special film. The results have been generally approved as of excellent quality. Difficulty of displication and restriction of the mass of image owing to loss of light by the absorption of the filters are confining the process to the assisteur field for the present.



TRANSPORTATION

FRED W. SARGENT
President, Change and Northwatern Railway Company

In THE year just past a pound of coal has been made to move a ton load of freight 7.74 miles, while in the previous year a pound of coal moved a ton 7.4 miles. That is a gain of about five per-

HE year 1928 passes into history. What was its importance to you and me? By what great discoveries, useful inventions, and gifts of knowledge will it best be remembered? We put these questions to recognized authorities in the various fields of science. We asked them to tell the readers of POPULAR SCIENCE MONTHLY briefly what, in their opinion, were the outstanding advances of the last twelve months. Their interesting answers, which appear on these pages, will aid you not only to keep in step with the front ranks of science, but to view with new understanding the prospects of still greater progress to come.



cent, seemingly insignificant on its face; yet it meant a saving of 3,800,000 tons of coal

Railroads have made marked advances in utilizing modern and inspected apphances. Automatic 1 rat beconted in coming into general use

Roller bearings on passenger cars are proving their worth. Cast steel terriers for locomotives, and cast steel trucks for cars, promise marked contoures. Larger and better freight cars are becoming widely used. Blany roads have been improved a terminals and metalling hump yards with electric automatic car retarders.

Elmer Sperry appears to have developed an electrical machine that will detect possible flaws in steel rads. And I think we have learned that we can lay rail seventy feet in length instead of thirty-nine feet, thus reducing the number of rail joints and otherwise providing a better and a smoother track.

Superheaters, syphons, back pressure steam gages, better boxes and grates, and larger power units have improved the steam locomotive. Gas-electric and linesel cars have been introduced, largely on light branch line runs and may gradually supplant the steam locomotive for certain classes of terminal service; but for general beavy switch and road had business the steam locomotive has yet no equal either in economy and efficiency.



DAVID SARNOFF Pres-Persid of and General Manager, Budget respection of America



THE radio art in 1928 targely emerged from the period of discovery to the application of electrical and engineering principles already developed in the laboratory. Chief of these developments was the perfection of the A C tube.

The use of radio in the bome has been reduced almost to the simplest terms. The new A.C. tube has stabilised the operation of the modern receiving set. A practically inexhaustable source of power has been made available for radio from

the electric light socket. Problems of installation, operation, and maintenance have been simplified. Other refinements have been in the direction of unicontrolled tuning processes and better tonal qualities.

Further fundamental progress in radio must awart the results of continued research into the wave channels of space. Our vision has been widened by the exploration thus far of short-wave channels. But there are many problems to solve. We have not vet plumbed the full possibilities of short-wave transmission.

Intil research determines the best channels of transmission and experiment teaches us how best to utilize them, television, despite technical progress made, must remain primarily a laboratory development. Demonstrations made during the year, however, showed marked progress in the electrical and mechanical components of right transmission.



ASTRONOMY

HARLOW SHAPLEY, PH.D.



THE year is notable above all things in instrumental development especially in the planming or building of great telescopes. The United States Bureau of Standards has succeeded in casting a glass disk pearly seventy

mehes in diameter and eleven inches thick, to be made into one of the largest telescopic interors in the world, at the Perkins Observatory, Delaware, Ohio. The new mxty-meh reflecting telescope for the southern station of Harvard Observatory has been nearly completed and will be erected, during next year near Bloemfontern. South Africa. This will be the largest telescope in the southem hemsphere. The Dias Poundation of Parts is reported to have assured the gift to France of a great Alpine observatoey, equipped with a large reflecting telescope. Grita totaling about half a million dollars have been made for the building of a modern observatory at Stockholm, Sweden, Funds are becoming available this year for initiating work on a 200-inch reflector, the greatest telescope of the world, planned for California.

Among the notable nonmstrumental developments are contributions from Holtand, Canada, and America to the evidence that the whole tralaxy rotates around a distant center in the southern

Milky Way, and discovery and measurement at Harvard and Hamburg of clouds of galaxies at distances up to a bundeed indison light years.



CHEMISTRY

ARTHUR D I ITT. E
Chemical Engineer, Microsoft Investor



O'E cannot do more than indicate in the benefest way a few of the more important results of the year's great activity in chemistry

Mach encouraging progress has been made in the chemistry of cancer.

There has been a

very notable synthesis of cone sugar.
The production of alcohols and other compounds from petroleum and natural gas is an accomplished fact.

Beryllium, the lightest known metal, is now produced in small quantities, and a process has been developed for plating aluminum on other gretals.

It has been demonstrated that wrought iron can be produced on a large scale without pudding.

The year has brought many proposals for the utilization of cornutality and other agricultural wastes as raw materials for industry, and much study is being devoted to the production of protein foods from yeast.

Vitamin D, an essential constituent of foods, is being produced commercially through the agency of ultra-violet light.

Synthetic processes requiring extremely high pressures are rapidly fluding a place in chemical industry

Perhaps the most agrificant of all developments is the discovery by Dr. Robert & Millikan of the powerful cosmic rays, which stream upon the carth.



At FRED REEVES
General Manager,
National Automobile Chamber of Commerce



With the both outstanding development marked 1928, trends were important, the most obvious relating to hody style. Dame Fashion has anded her fickle influence, (Cost, or page 188,



Must We All Wear Glasses?

Surprising Tests Show Why More than Half the World Now Need "Specs"—Interesting New Facts About Your Eyes

VERYBODY in the world as threatened with spectacles.

The percentage of people whose eyes are already glassed-in increases daily. Nearly half of a group of typical school children tested a few weeks ago by the United States Public Health Bervice were found to need glasses. Among four million children reported during 1927 to the Guild of Prescription Opticians, more than half proved to be in similar need.

In England, R. C. Raphael, of the National Institute of Industrial Psychology, recently estimated the bad eyes in the working population as between fifty and sixty percent Dr Ernest Clarke, speaking before the Royal Somety of Medic neurged that every eye found to be even slightly imperfect be corrected immediately by glusses; which would mean these eye aids for almost everybody, more occlusts report that absolutely perfect eyes are virtually unknown.

More against still as a recent British experiment, just reported by a governmental scientific organization, the Industrial Fatigue Bescarch Board. Going into two typical workshops engaged in fine work, experts of this board permaded every employee to put on

-By E. E. FREE-



THEN your eves feel tired and you are advised to consult an oculus, probably you are inclined to scott You believe that the professional charts and lenses, like the strange instrument above, are merely part of a conspiracy to burden your nose with spectacles.

And yet, Dr. E. L. Jones, an authority on nervous disorders, announced recently that simple exestrain may produce such serious consequences as heart ducase, anemus, and insormia.

The discoveries and tests described in this article are of importance to every man who strives for success in his work. properly fitted glames, whether he really needed them or not. The result, astoniahing to everybody except the experts, was that the workmen turned out more and better work than ever before without being a bit more tired at the end of the day; most of them found, indeed, that they were less tired Glasses for everybody proved to be the best production atimidant and efficiency improver that those factories ever discovered

FROM this to compulsory glames for every worker, or even for every worker, or even for every citizen, is not an unthinkable step. The time may come when every human being will be fatted with glasses on emerging from the cradle; when no one will think of appearing in public without his glasses any more than be would go out now without his clothes.

The usual idea is that all this indicates deterioration of haman eyesight. We remember Abraham Lancoln studying law books by the light of the cabin fire or Daniel Boone and Kit Carson recognizing friends or enemies twenty in less away across the plains. Such eyes, we say, no longer exist. Too much reading, or artificial light, or some other modern excunistance, has runed American eyes. Still clearer



evidence and Carrol B. Meritt, New York publisher, recently, is the public's imistent demand for larger and larger type in newspapers, magazines, and books. Small-print books, considered satisfactory by our grandparents, will neither be bought nor be read by the weak-cycl generation of today

IT IS by no means certain, however, that modern eyes are really worse than those of our grandparents or even of our remoter ancestors of envenan times. Imperfect eyes are nothing new. Two generations ago the great German physical Professor Helmholts is reported to have said that if any opticism sent him an instrument so imperfect as a human eye, he would send it instantly back. The Italian astronomer Gahleo, who died in 1642, is said to have made a similar remark

But such criticisms judge the eye as though it were a telescope or microscope, suitable only for that one thing and required to be perfect in it. As Sir John Parsons of Landon pointed out recently, the homan eye is a half dozen instruments in one. It is a camera with automatic focus adjustable from an infirsts distance to three or four suches. It has a range of sensitivity, without either overexposure or underexposure, thousands of times greater than any photographic plate. It is an excellent light-measuring photometer, it is a colormeter, a stereoscope, and a range finder. all combined

AND all these separate instruments are contained in the same tiny, mobile sphere less than a half nich in diameter. Like the pack-of-all-trades who is a mighty useful man to have around after a shipwreek or in any other emergency, the eye makes up in versatility what it lacks in precision. Eyes have served men well for perhaps a million years. Possibly the present world-wide failure of eyesight is because we are asking too much, not because human eyes are going back on the race.

The new British experiment with glasses for every worker supplies a chie as

to just what this excessive demand is The trouble, it suggests, is that we ask our eyes nowadays to do more accurate focusing than ever before and that we mast on maintaining this focus too continuously In addition to their age-old work as the body's jack-of-all trades, measuring colors and estimating the intensities of light and foung the distance of objects in front of us. we demand that our long-suffering opties behave with all the precision of perfect nutroscopes or telescopes. It is as though some apart ment - dwelling family expected a good cook and housekeeper, who could help out also by making all the family a clothes to be,

on top of everything else, an expert piano timer and able to fix the radio,

Two kinds of work were included in the British experiment. In one of the workrooms people were engaged in threading logges, sometimes handling more than Hall needle ever to the frech. The other weak noon we devoted between long small or a for the interior adelectric lamps the law class the prescriptions of the or other wave sun lar. First, any defects each worker's eyes were determined and allowed for. Next, the worker was given a pair of spectacles, the lenses of which were adjusted not only to his own eyes but to the precise distance of his work in front of him. Thus the strain of keeping his eyes forused on the work was avoided. His seeing was done at precisely the distance and adjustment easiest for his eyes. It was as though an ingensions photographer, intending to take a great many pertures all precisely alike and at the same distance, should construct a camera focused permanently for that distance and adjusted precisely for that kind of a photograph,

WHF\ a photog-rapher furnises a camera he usually servers the whole front of it in or out very carefully and exactly until everything is precisely in focus on the sensitive plate. To do this perfectly, as every amateur photographer knows, is not easy. even with accurately ground leases, precisely cut serews, and beavy metal guides to hold the camera box alsolutely true. Still more difficult is it with the human eye, which is merely a sack of flexible membranes distended by figurd and not held by anything rigid. Even the lens of the eye is an elastic structure, never precisely the same shape for two minutes in succession. It is as though a photographer tried to take first-class photographs by using a lens of table gelatin stuck on the mouth of a rubber hot water bottle to act as a camera.

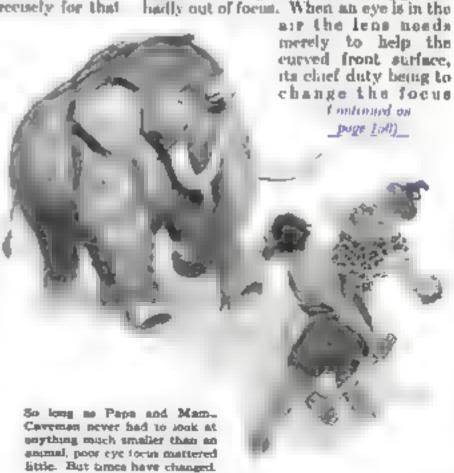
So long as mankind never had to look at anything much smaller than animals to be hinted or joints of meat roasting in the fire, which were the tasks of Papa and Mama Caveman, a poor eye focus made

no great difference.

But times have changed. Everybody reads type, much of which in spite of Mr. Merrit's emphasis on its prevailing enlargement, is still far too small for average eyes to focus on in comfort. Nearly everybody has jobs requiring close and accurate vision of machines or fabrics or something. We have come suddenly to demand of little brother's camera the same grade of work that a hundred-dollar professional instrument would do.

'ONTRARY to what most people behere, it is not the lens of the business eye which plays the chief part in focusing it. If our eyes had to depend entirely on their leases the eyeballs would need to be nearly three times as long as they are, which would make them stick out an such or so in front of the face like a lubster's. In reality, about two thirds of the work of making a useful image on the sensitive pervois ret on of the eye is done by the front muface of the eye itself; by that transparent, sensitive membrane called the cornea, over which the tears flow and which burts so painfully when the eye picks up a cinder. This corner is curved, like the bulging front of a lens, and it acts in the same way,

This explains why it is so difficult for human eyes to see under water. If water instead of air is in contact with the front surface of the eye the comes cannot perform its lenshke duties. The job of image-making is thrown entirely on the real lens inside the eye, and usually proves too much for it. Accordingly, the eyesight of a diver with his eyes open under water is always blurred and imperfect, as though be were wearing glasses.



A Fighting Skipper of the Air

The Enthralling Story of Dr. Hugo Eckener, Master of the Giant Graf Zeppelin, the First Air Merchantman

By ARTHUR A. STUART

AFELY stored in its home hangar at Friedrichshafen, Germany, the Graf Zoppelin, largest aircraft in existence and the world's first commercial dirigible, rested after her record-breaking eastward Atlantic crossing from America.

Greeted with booming of camou and ringing of bells following a transoceanic flight accomplished in seventyone bours and twelve minutes, the great areship inspired an elated Gernian population with bopes of the speedy establishment of a regular Zeppelin service between the Fatherland

and this country.

The Graf's arrival in Friedrichshafen occurred just three weeks after her departure on a trap to the United States and back. Reviewing the journey, which had been undertaken to demonstrate the possibilities of lighter-thansir craft as possenger and freight carriers. Dr. Hugo Eckener, designer, builder, and commander of the huge air liner, while confident of a rosy future for great aerial ships, did not appear to share the unqualified enthansism of his countrymen.

His expensives on both the outward and homebound courses had shown him. Dr. Eckener amounteed upon landing, that quicker and stronger dirigibles will have to be built before regular passenger service can be established with fair expectation of con-

tinued safety and success.

This opinion of his talked with views he expressed to me shortly after his arrival on this side of the Atlantic. Desirous of seeing the latest wonder of the air, and more especially of meeting the man who constructed her and photed her safely across the water, I went to Lakehurst, N. J., where the huge Naval hangar, harbor of the proud Los Angeles, was to house the Graf during her stay in America.

To WAS 5:98 o'clock of a bleak and chilly autumn evening, when the Zeppelin touched American noil after a storm-ridden voyage from Germany, during which she covered 0,500 miles in one hundred eleven and one-half hours of second-breaking nonstop long distance flight. The builder and skipper of this new leviathan of the air and of her sister, the Los Angeles, before her, stepped down on term firms and quickly crossed the field to the hangar.

Of generous proportions, gray-thatched, reddy-cheeked. Dr. Eczener resembled a sailor more than a fiyer, an admiral rather than an aviator. With his jaunty, clipped moustache and diminutive chin-whisker,

his merry blue eyes and ready smile, with his air of well-fed solulity that did not dulf a definite sense of therough-going efficiency, he needed but an opulent velvet costume, award, and buckled shoes to seem an incurration of one of Rembrandt's or Van Dyck's portruits of



A close-up view of the giant disciplife Grad Zeppelin on the vettled to touch the toil of America.

Title the conquest of the sir new realman from once form in the clouds, new and pre-turesque figures command world-wide attention. Of these modern folumbuses, few have captured public imagination more than the jaunty skipper who built and piloted the huge dirigible gross the storm-swept Atlantic and back. Here is told the picturesque story of Dr. Hugo Echener and his dramatic adventures.

reventeenth century Dutch burghers. This portly man, radiating power and good nature, is the master slapper of the sir, the idol of the German people, and the hero of two continents.

As he entered the huge naval hangar, he caught sight of the Los Angeles, which, as the ZR-3, he proted to this country four years ago. He made a gesture of

greeting toward the airship the I nited States won as a war prize. And a broad smile overspread his features as he exclaimed:

"Da ut mein Schatz"

Laterally translated, the German words meant: "There is my treasure." But colloquially, "Schatz" is often used in the sense of "sweetheart." And so, in the American vernacular, what Dr. Eckener really said was

"Yes, mr, that's my haby "

His eyes caressed the "haby"—a. 056-foot one!—with a glance as proud and tender as any father over bestowed on his child.

THE gesture, the words, the affec-I tionate look they all were typical of the big, "jovial Commodore, who, despite his many univenity degrees, he commanding position as head of the Zeppelin Works at Friedrichilsafen, hat achievements all a scientist and engineer, and his unique accomplishments as builder and master of the largest aircraft ever conceived, has remanned so thoroughly human that thousands of little Gretchens and Fritzes in the German schools volusteered their plennigs when it became known that "der grosse Luft Kapstaen" (the great air captain) had appealed to his people and government. for financial aid in building the first Zeppelin.

A kindly soul offered han a huge eight — a veritable Zeppelin among weeds. Lighting it with elaborate care and drawing the first pull, he eighed with intense contentment and said

"Ah! The first in four at a half

Seldom have I seen so much relish and enjoyment expressed in a haman countengace,

Then he was ready to tell the story of the historic flight, for though he had slept only eight hours out of the one hundred eleven and one half the trip required, he appeared fresh and unweared.

HE TOLD how he undertook the voyage regardless of bad-weather warnings to prove the air-worthiness of his great ship as a passenger liner and mail and freight carrier. And proudly be emphasized that "the little accident," as be called the ripping of the port homontal stabilizer in a storm 2,000 miles out over the Atlantic ocean, had served to help him prove his point!

For the most part, he spoke in correct English with a strong Teutonic accent But every so (Continued on page 125).



Dr. Hugo Echener—Builder and Master of Air Liners.

His latest souwer to critics of lighter-than-sir craft is the Graf Zeppette insightest durigible ever busched which he designed, built, and navigated across the Atlantic as be did the ZR J now the Los Angeles four years ago

EMEMBER the days when it was a popular pastime to see how many automobiles you could call by name as you met them on the road? Well, aviation today has arrived at that same thrilling stage of public

interest. So, on these pages, we are picturing most of the leading makes of sirplanes now operating in America. How many of them can you identify? Here's a chance to acquaint yourself with the latest flying craft.



Long, allow lines elletingwish the Course monoplane, a cable craft for three or four passengers. Another remarkable feature is the position of the leading wheels, which are placed well forward as an added minguised against the place's desiral over in case of rough landing.



Here is the buby of the swistion world—the Hasth monoplane. Leoks like a toy, doesn't at? But it will carry one person at the speed of 130 miles an hour—if that person is not extra large and heavy. It is one of the smellest of "filver" planes. In the air it because along like a long.



They call it the speedest of commercial plants—the Lockhard Vaga cable mostoplate, with its old class-shaped fusalege and a top speed of 168 miles an hour. This one is the Yankee Boodle, in which Art Gorbel recently deshed across continent in record time of less than 19 hours.



The trim Travel Air hipknes, widely used for private flying. You can spot it by the short lower wings, the upper wing notch above the pilot's cuckpit, and the pronounced stagger at which the wings are set.



The jumprious Back "Air Yacht," one of the fleattle-lien Francisco planes. It accommodates ten passengers, and boarts a heating and ventilating system, but and cold running water—even electric ciper lighters.



Here's a real coupy of the six—the Monocoupe, a stabby, sturdy cable, monoplane of strikingly small dimensions. It must two persons, croises at nearly nivety railes as hour, and is a popular ship with private pilots.



This handsome Wyan broughers a sister ship of Colonel Lindbergh's famous trans-Atlantic plane Spicit of St. Louis, sacrim live persons in its cabin and travels at a scaling spend of 108 miles as hour



One of the least aspensive of all communical planes is this Alco biplane, which has been found especially adaptable for use in training student flyers. It has a wing spread of thirty-two feet, and is driven by a 100-horsepower motor. Although not particularly speedy, its stability and safet of headling make it well suited to the beginner's first ettempts.



An odd compromise between monoplane and hiplans—the Bohi "Airsectar. a cutan hiplane with room for four passengers and the pilot. Its lower wing is extremely mirrow for a hiplane and is set forward at a considerable stagger. In 200-horsepower motor drives it at a cruising speed of skinety-five sules on hour. The wing span of the ship is forty-two feet.



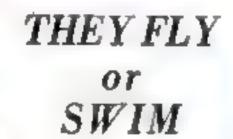
.



Another light three-seater, the Stearman hiplane. Its short lower wings and shock abstraing strain for rough landings will help you to identify it.



A commercial brother of Army bombers—the ten-passager Keystone "Pethfacter" cable bipleas—taking off at St. Thomas, Virgin Islands.





A Ryan Brougham seapland landing on lien Diego Bay Note the angle at which it first touches water. As speed de-creases, it artiles on even heel.

Left. Om of the enightiest of mapleoes, a Fokker Super Universal, taking off from the Hackenseck River New Jarany.



twin-metered St. borsity Amphibiers, above, to one Its distingualing morts are dwarfed Lower wings, and lefty twin redders.

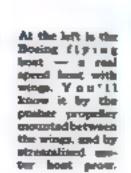


For craims of shore, the Patreigld cable sur-

plane offers sir purktumen proofers and pleasure.

that can alight either on land or water. The wheels fold.

5 4





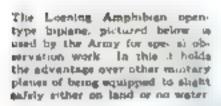
Letest model Locateg Amphibian, a roomy cubin craft ewey beto the hall when it is being used as a susplane.



Swift up a dart in this Army standard pursuit plans, the single-matter Curtine. The Critica "Falcat." attach plans. Its function is to every open many in-"Hawk." It can fly 160 miles an hour. The rôle of pursuit planes is to strack factory or tanks and rake them with streams of bullets from its six machine gues, the invading enemy six rest in equadrons. Each plans carries two machine gams. There are bomb racks, too, in its lower wings. It speeds at 140 miles as hour.



Speedy Winged Warriors of the Army





feet or more than three miles well beyond the range of enemy and secret gues, where it can carry on reconnectering operations Its single motor drives it at a crusing speed of 115 miles an hour



The Keystone "Pirete. at the left to Ducly Som v standard ight bombung plane. It can loose a ton of deathdeeling bombe upun enemy troops and munition depote. At this writing, mormous new bombers a : a undergoing service tests to pick a heavyweight mate for this lighter type

Rnokus cadets at the Air Corps Flying Schools get their first air rides to Consolidated training planes, the the one shows below its him tandem sents for matractor and student and is fitted with dual controls. A Wright motor drives it at a speed of 105 miles on hour





Another of the Army's modern attack ships in the Boring purpost plane. Like the Curtus. Hawk, it is a single-senter highair equipped with machine guts. You can tell it from the Hawk by to more topered upper and aborter tower wings.



port on an auteraft carrier.

Sidelights of Air Progress



New Helmet for Pilote

The latest improvement over the clumpy "factball" headgest once were by pilots is this right, close fitting believe of soft leather designed by the U.B. Army flignal Corps. Attached our phouse and a telephone mouthpiere strapped to the chest enable pilot to hear messages undisturbed by the engenc's ross. Since May, 1926, the planes of one of America's largest air transport concerns have flown more than 3,000,000 miles without injury to a passenger or loss of an ounce of mail or express. Aviation owes its wonderful records of service not to any particular invention, but to hundreds of valuable ideas like those described on three pages,



To Guide Byrd Flyers

When ploton of the Byrd Antarctic Expedition begin their onpiorations over the Bouth Folarice cap, this new bubble extent invested by Commander Byrdwill camble the pilots to establish their location quickly and accurately. Raigh L Shropshire, sesistant havingstor of the expedition, is shown testing the device,



Yann ugo experts sh their hands when J C H. Eliebammer, fatteun inventor income on "the Edinas of designed this Desmark, " first redial oir cooled prigtion meter. Yet reveally, when he exhibited his early model and possed for the above photo, he revealed that it is strikingly similar to its femous present day descendant, the Wright Which drove Lindbargh, Byrd, and Chambirlin across the Atlantic.



Map Cuides Air-Mail Clorks

the reputity are air-mail lines increasing that post office cleries have to keep a map of the course before them while sorting the mails. This picture, taken in the Chicago post office, shows the clerks handling a flood of air-mail letters, guided by a wall map of the various lines. Mail planes now fly 9,000,000 miles a year over lines traversing thirty-live states and serving \$1,000,000 people. Ten years upon there was but one line covering 100 miles.

Inventa Magnetio Altimater

Lean Therwesis, youing Rusnian professor whom "ether imaic" device was described not long ago in Possuan Scrawer. Mossue, y. in menhere with his latest invention—a magnetic siting-twwhich, he says, tells a fiyer his stract height above the earth in thickness fing. The device with up an electromagnetic field above a recording instrument. This field, says the inventor, varies with the distance to earth; variations are recorded on a dial in terms of sititude.

Testing Effects of High Altitude

Bennations experienced by an stream climbing into swelled atmosphere are duplicated on the ground with a new experimental apparatus (left) devised in Germany. To a steel tank the man being tested is subjected to decreasing air pressure and supply of oxygen. An observer notes the effects,

Gliders and Autogiros to Go on the Market—The Army's New Bomber Advances in Flying Science

SON you will be able to purchase your own "training" girder or motorless flying machine if you desire. In Michigan, according to a preliminary announcement, a newly-formed corporation plans to establish what is probably America's first glider factory. Its first motorless model towed into the air with ropes by a ground crew and kept aloft by the pilot a saill in taking advantage of rising breezes, is to be known as the PT-1, or primary training machine. A more advanced training traft, and other sources for experienced glider pilots, will follow later.

Cluder flying as a spect in this country received tremendous impetus from the recent Massachusetts glider flights of German experts, who declared that the United States abounds with ideal gliding country. The new manufacturing firm, created to meet the demand for gliders, nombers among its directors Edward Stanson. William B. Stout, Capt. E. V. Bickesbacker, and other nationally prominent figures in the aviation and motor worlds.

New Bombers Fly High

NEW bombing planes which the triny plans to launch during the coming year will be able to drop their deadly intended from an altitude of more than three miles. The new high "ceiling" will place these craft farther from the effective range of "arches," or antiaircraft guns, according to Air Curps officials, Present bombers have a high-flying limit of about two miles. Moreover, the new craft will be able to drop bombs 300 or 300 miles from its base, an advantage of more than 100 miles over the older type.

Such planes are likely to cause new developments in war tactics. Already it is claimed that a delicate "mechanical ear" developed some time ago to detect the hum of approaching bombers can be rendered ineffective by moding a single scout plane flying close to earth near by. Its roar then drowns out the sounds of the bombers' motors.

Will Market Autogiros

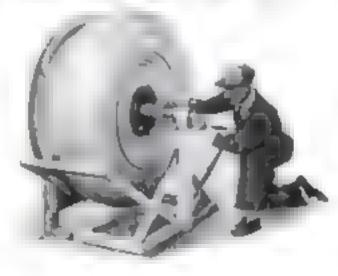
I IGHT autogro planes are soon to be marketed, according to Juan de la Cierva, inventor of this novel "windmill" type of craft. In initial tests at Hamble Airdrome, England, a two-scater model developed eighty horsepower.

The new model is similar to the larger autogro in which De la Cierva recently risde a successful 1,500 mde tour of continental Europe, as described last month in Popular Science Montelly.

Warns of Flying Ailments

WILL man's physique and personality change if aviation becomes as common as motoring? Grave flying ills may become general, in the opinion of Lieut. Col. Levy M. Hathaway, Chief Flight Surgeon, U. S. Army Air Corps, At least two senious ailments peculiar to aviators have already been noted by Col Hathaway based on his observations of Air Corps personnel

Eyes and cars are first to fail, he says. Nearly all veteran pilots are deaf to a certain degree, from continued exposure to motor roar, though all had good hearing when they entered the service. Eye strain and unbalanced eye musdes follow the prolonged eagle-eyed vigil of day and night flying. Other organs may be



Safety Valve for Super-Dirigible

I IVES of postungers on the Scritch military of super-decigible the R 101 now under construction at Cardington, England, will be protected by this bugs manuscring valve which will outcomstically regulate the gos pressure enthin the bag. The spring, which the pre-hank is adjusting to the picture holds the valve closed until pressure from within posses the slanger mark. Then it is how the valve to open until enough gos has excepted to restore normal pre-sure. The picture gives an idea of the mechanical marvels embodied in the R 101 and its enter ship, the R 100 which are expected to isosupative trust Atlantic passenger service test tomager. They are the largest thips of the sky ever designed. Each will be twice so large in the Los Angelow.

affected. Col. Hathaway adds, but it is too early to determine their permanent change, if any. However he has noticed a high degree of neurosis, or nerve affection, among aviators.

Water or Air Cooling?

PITI RE ocean-going planes, carrying 100 or more passengers, may employ water-cooled engines, according to L. M. Woolson, Packard Motor Company aeronautic engineer, "Such planes," he erecutive told the Society of Automotive Engineers, "will demand enormously powerful engines, and it is inconceivable that the great parasitic resistance of many externally-mounted aer-cooled power plants can be permitted."

Experts divide sharply on the respective ments of air-cooled and water-cooled airplane engines in general. Advocates of the air-cooled type point to its light weight, its simplicity and freedom from mechanical trouble, as demonstrated in many transocean flights, its rapid warming up, and its lesses vulnerability from projectiles. Champsons of water-cooled engines, on the other hand, emphasize that these can be designed with less wind resistance; and that there is greater latitude in the design and placing of the engine, since adequate flow of cooling air is no longer required.

Novel Launching Device

SLIDING planes into the water from Sahip decles, so that they can take off under their own power, is made possible through the invention of a German engineer named Hammann. In this plan,

which aims to rival the present method of launching planes directly with cataputts, a slanting platform extends from the ship's deck to the water's edge. A section of sail serves as a sort of eradic to lower the plane into the water, or hour it abound again,

Tests of the new scheme are in progress near Warnemuends, on the Baltic Sea. The North German Lloyd steamship line has loaned the liner Roland for the purpose.

Cables to Guide Planes

ELECTRIC cables bursed underground would gode airplanes across treacherous mountain ranges and into airports, in a new system devised by a French inventor named both. Delicate instruments in the plane's control caban, both says, could enable the polot to follow an earth cable 8,000 feet beneath him.

A sundar system has been successfully tested as a means to guide a ship into a barbor. Here the guiding electric line is sunk to the sea bottom.

Dispel Fog by Heat

ARTIFICIALLY warming the open A sir over a landing field in the latest weapon against fog. In expensions areas up to 800 yards in diameter have been cleared in this way, Lieut, Albert E. Hegenberger, U. S. Air Corps, recently told the aviation section of the National Safety Council. However, it remains to be seen if this method is commercially practicable upon a large scale.

Although calculations indicate that, theoretically, thirteen turn of coal an hour should clear a 400-yard-square field of log of average thickness and drift, in practice more might be needed due to the heat's dissipation in the open say.

Tragedy Follows Record

Till fog got Capt. C. B. D. Codyer, champion globe riveler and his passenger, Harry Tucker, the other day. Their famous Lockheed plane You'ves Doodle, holder of two cross-continent records, crashed in a log upon an Arisona crag, killing both.

They had bettered all existing records for speedy crossing of the United States from east to west only a few days before, making the New York—Los Angeles flight

in twenty-five bours.

Detectives of Science Solve Mysteries Buried for Centuries



lifting new cluss to the romance of ancient Carthage. Count Byron Kuhn de Prorok rights leader of the Prance-American expedition into northern Africa, and Prof. Henry S. Weshington, representing Carnegia Institution, quantuming mortal from a Phoenician altar. Above: Excavating tombol Queen Tur-Hissan.

By MICHEL MOK

trails that lead to strange Mayan cities buried in the jungle, of treasure, ages old, dug from the sands of the

desert, of handwriting clues to vanished men-

exploits are eccounted here. It is the story of faint

TE patient, careful afting of wome serliment encountered in the course of quarrying at Folsom, New Mexico, recently led Barnum Brown, paleontologist of the American Museum of Natural History, to the startling conchason that America was inhabited by human beings from 15,000 to 20,000 years ago!

These findings placed the beginning of man on this continent in the late Pleistocene period-centuries before the time previously faced by theories accepted generally,

Brown's revolutionary discovery and the manner in which it was made strikingly ulustrate the fact that the archeologist plays the fascinating rôte of a Sherlock Holmes in the drama of modern science. The counterpart of Sir Arthur Conan Doyle s genius of Baker Street lives and labors in the furthest reaches of the earth, where men of knowledge, unquenchable enthusiasm and unflagging persistence doggedly trace humanity a footprints on the sands

To learn the details of man's life bank through the ages and from this rich lore of habits, customs, behavior,

and languages to reconstruct his checkered career, these scientists employ the methods that constitute the elements of



In the heart of the Yoratan jungles the trail led to these magnificent remainds of ancient Mayon architecture.

every good mystery thriller. For breathtalong suspense, tense conflict, and the joy of ultimate triumph after harrowing

hardships overcome, the archrologast's adventures not only rival but surpass those of the boldest and eleverest alguth of fiction.

He follows slender closs that take him from one end of the world to the other; he afts to the bottom evidence so alight as to appear uscless to the layman; be gathers facts from the test tube and the textbook, he makes deductions from the position and the course of stars, he deciphers codes, the key of which seems often lost in the mists of antiquity—yes, at times he even resorts to what resemble third-degree taction to force reluctant. witnesses to testify

AND in the end, his unrenutting efforts, like those of the hero of detective tales, are crowned with a capture. He captures man in all his weakness, perhaps, but also in all his glory of intellectual social economic. and artistic development—man as be emerged from the dawn of primeval periods and slowly grew from a groping, primitive creature into a complex, masterful personslity

Some of the best ingredients that make mystery yarms are contained in the story of Barnum Brown's discovery, which showed that the inhabitants of this continent from 15,000 to 20,000 years ago had attained a degree of culture comparable to that of the preinstoric Egyptians, and which was propositioned by leading serentists in this country and abroad "the best proof ever offered to date of the antiquity of man in America.

OUARRYING at Folsom uncovered a sediment consisting mostly of windblown materials. This sectimentation from four to moe feet deep, was subjected to expert examination. It here the earmarks of rainfall conditions that have been associated with the retrial of the glaciers in the Pleistocene age

Here was the first cige. The chronological phase of the invest gation was established. Then the sed ment was slowly removed and st was found that it had covered

the hones of a berd of thirty bason of a species long extinct. Next, the archeologust and bin assixtants came upon the richest treasure. It was a mere handful of some as teen arrowheads of charcedony and jasper, fluted and shaped like bellowground rasor blades. All of the arrowheads but one were broken, but what remained showed a workmanalop that equals if not aurpasses anything beretofore discovered in Amer-The fragments of ict. these weapons revealed a

technique like that possessed by the early Egyptians. On the basis of this evidence. Brown and his pules reconstructed a distinct culture anrelated to even the earliest manifestations of intelligent human life previously encountered in this country

Keen detective work by De Moss Bowers, a California archeologut, recently led to equally interesting results. A study of more than 7,000 skulls which he found slong Santa Monica Bay gave

harper a new the Manual is to in the distribution of Central Argest in early to early on 1 to 19 5, a store or with the store of the stor A She In P. Magna. to ora Cata I and Cart TO HOUSE BE evidence of the fact that operent inhabitants of the southern Cabiorna.

coast were the world's first dentists! Bowers saw that teeth had been artificasty extracted from some of the skulls. Several of the teeth had although of pulversed stone and asphalt. He continued his digging with redoubled enthusiasus Soon he found, among beaps of implements and utenals, what were unmistak ably dental instruments, fashioned of bone and shelis.

These findings served the archeologist

as the groundwork of an extensive theses, ic which he showed that only in one other place dental tools of such an early period. had been found. That was a Bab. i. halves the as as easy of a wege of metin. their right most have been later. So the fact that the first destarts plied their teads in the region which now supplies the world with movies was seventified by eatingushed

No hero of detective novels ever did a neater piece of work Dunt (Int a conshed by Auguste Ferdinand Francesa Marsette, the world-famous French Egyptor tologust. Looking for Coptic manuscripts

the writings of the early native Christians of Egypt-in Alexandria, Egypt, in the second half of the nineteenth century, Mariette noticed some sphirkes in the gardens of high officials. When, some time later, he saw simour sphinx figures at G as and Carro, the aim occurred to him that all night have been transported from one single rum.

But where was that run? One day, while walking near Sappara, Egypt, he found a sphenx half buried in the said. At that moment, by enneadence, he remembered Strato and a sign ficant paragraph written by that Greek geographer 2,000 years ago: "One finds also (at Memphas) a temple of Serapis in a spot so sandy that the wind cames the sand to accumulate in hears, under which we could see many sphinges."

A SLENDER clue, but sufficient for a A sleuth of the caliber of Manette! He dug at the sphine and found an inscription. Eurekal This was Strabo's Memphia, This was the Egyptian Seration where the sacred bulls were buried with a funeral worthy of a Pharnoh. Mariette gathered a group of workmen, strapped off the sand. and revealed an avenue of 141 solunxer leading to the massive bull caskets housed. in a quarter nule of galleries.

"Elemental, Watson; elemental" Another piece of scientific detective work, demonstrating the archeologist's resourcefulness, some years ago resulted



Howard Carter American archeologist, rolling back the should of King Tut-enkb-Americ coffic. The splendors of the ancient Pharach's touch cause in a reward for sixteen years of patient search.

in locating the exact site of the ancient American city of Quivers.

A farmer near Riverton, Neb., plowing his field one day, hit upon a very old, grime-covered saddle sturup. It looked so strange to him that he sent it to the state miseum. Here it was recognised as being the exact counterpart of those used for centuries by Moorish horsemen and Spanish knights.

THIS discovery so stored the Nebraska archeologists that one of them, James W. Savage, made a trip to Madrid, where he delved in the Spanish court archives concerning the expeditions of

Coronado, Castaneda Penalosa, and others to the Kingdom of Quivera.

As a result of years of research, Savage and Dr. Robert F. Calder, of Onndus, reserved in fixing the location of the City of Quivers, for which Coronado and the old Spanish conquerors searched so diagently and fought so valuantly. They found the great appears of the great appears o

rusus of the great ancient esty on the Loup River, a tributary of the Platte.

Secret codes! They certainly are recognized by readers of mystery fiction as one of the standard devices of detective tales. When the slenth manages to decipher the cryptic writing, it is a pretty good guess that the sumison of the coignia is close at hand and the book neuror firished. But here is a story of secret writing that was told to instalments covering him dreds of veges."

TWENTY years before Colom bus discovered America, some travelers among the ancient ruins or of Persia were attracted by strange wedge-shaped characters cut in the rocks or molded in little tablets of clay. A few of the tablets were taken to the insuscume of Europe and kept as curios, and guesses were made from time to time as to what thes cursous language was.

"Continued in our next!" Nearly three hundred years elapsed before any further progress was made. Then somebody noticed that the wedges were ar-

ranged in three different formations. He guessed they were in three languages—probably Persian, Samue, and Babylonian. His guess was an impolione, and scholars became interested.

In 1763, the tableta had been studied sufficiently to convince scient start hat they should be read from left to right. Then the theory was advanced that a frequently occurring wedge, pointing downward instead of being horizontal, was used to separate the words. After this, progress was more swift.

Several scholarly detre-



Uncovering a mysterious buried city in morthern Nevuda, discovered by a party led by M. R. Harrington of the Museum of the American Indian.

tives were certain that they had discovered the signs for a, b, d, and other letters. One thought he had determined at last how many letters the strange alphabet contained. Another decided that a frequently appearing word in the ancient



Under sends of the Librar, desert in northern Africa, exchaningists on during transvers of the section Roman city of Leptin Magna,

writings was apt to stand for "king" and spent years trying to get somewhere from that slender premise.

Again, "continued in our next!" Some light and more confusion was thrown on the mystery when, in the early part of the mosternth century. Prof. Christian Lassen, an emment Swim scholar discovered that the "cunciform language" (for that was its name) was a form of stemographic writing, not very much unlike modern shorthand in priociple. Some of the characters stood for letters, others for syllables, and others again for whole words.

In 1847, Ser Henry Rawhnson, then a young British officer, made a great discovery. He found a cunciform macription on the rocks of Behastun, chuseled in Greek, Persian, and Babytonian under the personal supervision of Danus the Great, ruler of the ancient Persian empire from \$21 to 485 p.c. The key was found at last!

BUT how long did it take Sir Henry to do thus little detective job? After an entire year's study, he sent to

London a translation of the first two paragraphs, containing the name, titles, and genealogy of Darrus the Great

Is there a sleetly in fiction more interesting than this amateur philologist, using up his annual leave sitting on the bot sands with field glasses pressed to his trying to read an eternal billboard.

which an ancient tyrust had carved high up on the rocks to advertise his own fame and prowess?

But Rawlessor's discovery of the key didn't make reading of the lablets an easy task by any means. It remained an intellectual stant of the first magnitude to work out a single one of them.

To make a long story short, it was an American expedition, consisting of archeologists of the University of Pennaylvania, that fittelly solved the riddle. And what a riddle it was! I atil this very day the accentific and theological worlds are agog as a result of the revelations. One of the tablets told of the delage as having happened not 4,000 but \$6,000 years.

ago! Another related the history of the creation and fixed the time at a half million years before that! Another told of Noah, with a Sumerian instead of a Semitic name, and aversed that he and not Adam ate of the forbidden fruit!

MUCH closer home is the scene of another remarkable archeological detective yars, and its time is much more recent, too. Only a year ago, the finesse of

an American sleuth of serence solved the secret riddle of the Maya calendar

I neutan was the bome of the Mayas, the dominant Indian race of Mexico and part of Central America at the time of the Spanish conquests, but the first clue to their writings was discovered in a dusty library in Madrid to 1863. The first real advance in solving the eingens was made at Decsden in 1890" important correlations were accomplished at Washington, D. C., in the last twenty years, and the final interpretation of Mayan history in terms of Continued on page 157,



Ruins of the royal palace in the \$.000-year-old city of Kish, once the center of the mighty Sumerian civilization, whose secrets have been due from the desert by the Field Moseum-Oxford University expedition. The palace covered two acres,

Famous Magic Tricks Explained

NOTHER absorbing article revealing deep secrets of legerdemain never before told to the public. An expert takes you back-stage and shows how, by applying simple mechanical principles, magicians escape from coffins, water tanks, and bags, and perform all manner of mysteries.

By GEORGE S. GREENE

the magician wishes to "switch" one article for another, be merely given part of the handle a half turn, which changes the silk partition to the opposite side of the bag. Then be turns the bag inside out after dropping the duplicate from it. Taken off stage, the bag is emptied of the original article by an assistant, who "loads" the article into a loaf of bread or ties it around the neck of a raboit, to be returned to its owner.

SUCH appartenances are indepensable to a magneal performance, and there are countless others. They combine the inventiveness of magneaus some before the days of the famous Caghostra. They are made in mode, workshops by men who are specialots in woodcraft and metal-working electricity and psychology, and the ideas worked out are, in many cases, equal in eleversem to the products of our modern inventors of airplanes, rathe, and electrical devices.

I was once present at the performance of a famous magning whose feature track was "burning alive a woman." As you doubtiess know, thus consists of placing a young woman on a stand or table, covering her with a gasoline-soaked acreen, and then bighting the acreen. At the performance I attended, several woman fainted others acreained, and one man wanted to call the fire department. When the ashes of the acreen were cleared away all that remained on the table was a pice of bones and a skullf

The table, of course, was tracked. Between the top and the floor was a mirror, set at an angle which concealed a compartment in which the girl could hade. The reflections in the mirror caused spectators to imagine they could see through the legs of the table. The girl merely made an opening in the back of the paper screen, descended to the concealed compartment, and placed the bones and skull on the table in her piace?

ON A similar properple are based the carnival sule show illusions, commonly called "Spadora" and "The Woman without a Body". The mirror conceals the presence of the body, leaving the girl's head resting on a sword at the edge of the mirror.

Since the times of the earliest European magerians, trunks have played a valuable part in the repertoire of the magician, Usually they are used to make young women disappear and respect. The most common method is to place the trunk on casters and remove the back.



of the mechanical devices which enable a magician to fool his audience and of the men who spend their time and ingenisty in creating new apparatus for performent to use. I explained how many of the tricks are accomplished by applying simple laws of science. In this article, some of the most baffling feats of legerdenism are revealed as clever utilizing of the products of the workshop and the laboratory

You probably have seen a magician drop a handkerchief into a glass goblet, wave his hand over it, and presto! the handkerchief is gone. The explanation is simple. The goblet has a partition in it. The partition stands vertically and consists of a sheet of steel cut to fit the glass, silvered and then polished to mirror brightness. Due to reflections, the mirror partition is invisible. The handkerchief is dropped in one side of the goblet and when the glass is turned half around, under cover of the hand, the handkerchief appears to have vanished.

Rubber vacuum cups, soch as are used

to fasten glare shields to the automobile windshield and arivertisements to show windows, are equipped by magicians with a ratgut loop and used to vanish billiard halo. The loop, invisible against the hand, is placed over the thumb. The vacuum cup is pressed to a billiard hall in the hands, and with a twist, hall and surfing cup are shifted to the back of the hand, quite invisible.

Have you ever offered your gold watch to a magician, and then watched him pound it to fragments in a mortar, and later return it in good condition? Did the magician collect the watch in a little

The "changing bag" is used to exchange valuable articles for substitutes. It consists of a rim to which is sewed a black alk bag, and fastened to the rim is a black or nickel handle to carry it by What you do not see is that the bag has a black salk inner partition sewed to a wire half-circle that fits inside the rim. When

In place of the back is inserted a combination take back and bottom, fastened at right angles with angle moss. The prican enter the trunk and, when it is closed, push on the back, which tips out and down to form a shelf on the outude of the trunk. At the same time the fake bottom rises and fits into the trunk back. An illustration at the bottom of this page shows the construction.

One of the strangest of majoral illusions is called "The Rapping Hand" or "The Mummy Hand." Years ago a certain American magician visiting Egypt heard there a story, told by the natives, of a mummified hand of an ancient

Egyptian princess which suddenly came to life Oureturning to the United States he invented the present-day magical mystery,

The trick consists of a polished board of redwood and a "minimy" hand, which is beautifully made from hand carved wood, and enampled fiesh color, the wrist being covered with velvet and a lace cuif. The band, placed on the hoard, seemingly

comes to his, by tilting the fingers to tap on the board. Usually the hand and the board are passed among the spectators for examination.

The trick water bowl.

first exhibited empty. it

mytterrously fills stack again,

and again. The trick her in a

secret water compartment

punctured by a small hole

DRAWING at the foot of this page shows the construction of the board, and how it controls the movement of the hand. On the underside, at each end, are small wouden strips, fastened to the board with screws. One of the screws is "faked", in reality, it passes through the board, connecting with a leverage device. that forces a needle-like plunger to non from a tiny hole in the top of the board. The plunger is operated by pressing the acrew, and the latter can be locked, immovable, by giving it a half turn. The hand is merely placed over the plunger, which causes the wrist to rise and the fingers to strike the wood!

One performer, well known as a magneral, but essentially an "escape artist," achieved frame in the United States and abroad through his uncanny ability to escape from a locked steel visit, Once inside the vault he removed a tiny flashight, can of oil, and serew driver from concealment on his body, and



Locker in the trunk, the girl response? She simply pushes on the fake back which tips fown, lets her out, and again closes the trunk.

with these removed the vault manufacturer's name plate from the inside of the vault door. This exposed the tumbiers, which he was able to mampulate and so open the door. He then replaced the plate, wiped the oil from the screws, stepped out, and relocked the vault. The escapes were pronounced miracles, and spiritualists gave him credit for demateralizing himself. Such as fame, accured through a knowledge of mechanics and psychology

The appearance of a coffin on the stage always sends

taken advantage of this by escaping from coffins. The performer is strapped into a strait-packet and placed in the coffin—a genuine one borrowed for the purpose from a local undertaker. The top of the coffin is strapped down. The performer makes the seemingly impossible escape in several minutes, inside a cabinet. A knowledge of mechanics does the trick. He ships the strait-

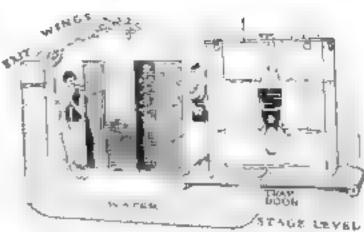


jacket up over his head slowly in the customary escape manner, and, when free, takes advantage of a fact that the layman does not generally know; that is, that with most coffins, the lid is in two parts, the upper part being removable so that the body of the dead can be viewed from the waist upward. It is out of this opening that the performer makes his escape, and another "marsele" is performed.

It is easy to escape from a sack into

which you have been tied will you have the nerve. The professional magiciant wads up his bandkerchief and places it in the neck of the sack when it is tied from the outside. When a screen has been placed around the sack by attendants, the magician pulls the handkerchief out, thus leaving plenty of slack in the tope around the neck so that he can

casely work the rope upward and off.
Among the countless present-day magical uncovations that have given fame
to their inventors, the escape from a
"water cell" stands prominent. It depends entirely on a well-known but unsuspected scientific principle; dosens of



"Weter cell" encape. The magician plunges into a water-filled glass tank. Servered momentarily, he vanishes through trapdost to water pipe under stage.

magicians have attempted to mutate it, but without success.

A large cell, or glass inclosure, is exhibited in the center of the stage. It apparently consists of a number of sheets of piate glass paned into an inclosure with rubber gaskets so as to be water-tight. What makes the illusion so puszing is that the "water cell" can be distinctly seen through. The glass tank is filled with water, into which the performer plunges. The tank is immediately concessed with screens, and when again revealed, the performer has escaped from it.

The escape depends on the fact that water seeks its own level. A metal tube large enough in diameter for a man to enail through leads from a trapdoor in the bottom of the tank, underneath the stage, and emerges behind the aide drops, extending up to the name height as the glass tank. The trap door is made of a square of glass without hinges, the under side being covered with a piece of wood matching the tank platform. The performer has merely to slide the trapdoor ande, enter the tube, and replace the door; then crawl to the exit at the other end of the tube, where the water mes to the same level as in the tank.

O'E can apparently see underseath the tank, because the tube, where it connects with the trap, is concealed behind a black drapery matching the backdrop and therefore invisible. To perform the feat, one must, of course, have the ability to stay under water for the maguite or two required.

In the same entegory as the "walking through a brick wall" trick, described in a previous article, is the "Packing

Case Escape." A large wood shipping container is obtained from a "local" men and the performer rate it. Various methods of escape are used, "fixing" the box just before the performance is the most common. Fixing is accomplished by removing certain nails in the box, cutting them in half, and removing the head part back in the

boles. Other performers carry their own boxes, with carpenter-made trick panels for an exit. The simplest method used, however, is a leverage device, which can be collapsed to fit into the performer's pockets. Once made the box, he can put it together again. (Continued on page 185)



The "Monmy Rand" A plusger operated by fake acres, makes fingers top on board.

LAMING letters of scarlet sixty feet high flash the word "RICHFILLD" from a hill overlooking Portland. Oregon. Completed a few weeks ago, they form what is said to be the largest electric sign in the world. A threestory house could nestle comfortably under the crossbar of the H . The monster display serves as an aerial beacon and landmark, besides advertising the product of the ol company that erected it, for the 725-foot row of letters can be read more than twenty miles away!

From one and of the country to the other, today, appears the familiar red glow of these "neon" mgns-so called because these glass tubes contain the strangest of rare gases, neon, captured and isolated from the atmosphere, its native haunt. They udvertise banks and fectories, moving pictures and bacuta. Bracons, too, of searlet neon light, pieres log and most to guide airplanes safely to port, Returning the compliment, one great airplane, the largest commercial muchine in the United States, displays on its lower wing a huge neon advertising sign to flash from the sky the ments of a rigarette or auto oil. In widery diverse fields-television, for

LL thus has happened recently, yet A this year is the thirtieth anniversary of neon's discovery. And the process by which it is made today is surprisingly similar to that he which Ser William Ramany, English chemost, first found it. Distilling liquid air chilled to the inconcervable cold-temperature of more than 400 degrees below zero, F., he observed a strange gas boiling off. This be named 'neon," meaning new Today in

instance—neon is pressed into service.

air until it becomes a clear blush white liquid and then capturing been as it evaporates away

For neon is everywhere in the me, mixed with the oxygen, a trogen and other constitnents that you breathe dany. But so small us sta actual quantity that in three or four hours you will have breathed but a single langful of neon. There is only a thombleful as as much air as you could put in a



New type of revolving mean airport beacon. The glass bulb at center contains near gas. Energy from a mentunding electric real causes it to light.

Neon, Magic Gas

That Lights the Way

Through Fog

By H. C. DAVIS

railroad tank ear; specifically the proportion is about twelve parts in a million of aar,

A pound of neon would cost you shout ten thousand dollars. This curious, colorless, muctave gas does just one thing and does it so well that it is many times worth its weight in gold. When an electric current is passed through it in a pear-vacuum, it glows with the peculiarly brilliant firry-red tint that by now is familiar to every American.

Makers of electric signs buy the neon gas in timewalled glass bulbs, each containing about a quart. Of course the colorless gas within is invisible, a full bulb looks the same as an empty one. Every precaution is taken to avoid breaking, else the precious gas, worth about \$20 a balt-ful, would excupe back aito the air whence it came. Hollow glass tubes are twisted, by a combined heat and bowing process, into the fantastic shapes required. to make script letters and advertising text. Air within them is sucked out by a vacanta pump. Then a bulb of the neon gas is booked on. valve turned, and the gus slowly brases into the tube. One bulb contains enough gas to fill two or three hundred feet of average-mand tuhing, for only a little is required; so little, in fact, that the pressure with n the finished tube is but the timest fraction of the outside atmosphere's-often a hundredth part of it or less,

IN THIS near-vacuum, an , electric current does strange tricks. It can leap across great distances that would utterly baffle it in me. Instead of sparking, it makes the surrounding gas

glow with a broad, diffused light. When neon gas surrounds the two electrodes scaled within the tube, a brilliant scarlet tongue of fire leaps, between them. There is no glowing filament, as in an ordinary electric lamp bulb—only the curiour cold, pulsing light of the gas itself.

It need not be red. If a couple of drops of mercury are inserted in the tube of neon, for example, its light becomes a St II with the mereury brailiant blue.

> added but in a yellow finled tube instead of a colorless one, the light becomes

green. So intense in this light that neon advertising Figure cat, he seen plainly in broad Gary Will as well as at night and many stores keep them lit all day Their characterstic bue is an attention drawmg centrast in a

> (Cantinued on page 15



Links in the Chain of Science

Every bow and then such a query comes from somebody who sees in it only a cold intellectual subject remote from life. And the answer is tike an endless chain it starts anywhere and keeps on going forever. Consider, for example, as I did, the bits of news that flow over a single desk in the office of Populan Science Montrally in just one week.

Here is a report of a dancing mouse

that for unreteen hours leaped about and chased its tail the other day while it breathed, in safety, nothing but illuminating gas. And as a result, before long, we may be able to light our houses and cook our meals with gas which can be breathed in quantity without danger or discomfort.

One of the prices humanity pays for convenience and liberation from labor has always been a greater hazard of seculert, Speed by rail, by automobile, and by air has been achieved at the price of safety. Gas as fuel has been far more convenient. than the fire pots of pioneer days, but the toll of deaths from asphyxiation from gas leakage mounted yearly. Then Dr. Arthur D. Lattle, of Cambridge, Mass., developed a simple method of converting ordinary illuminuting gas into the harmless gus tested on the mouse. Besides being rafe, it retains all of its heating properties and in the conversion process yields valuable by-products.

A FEW years ago, it was predicted that gas as a fuel and diagrament would be displaced by electricity and that all gasgenerating plants would be abandoned. This has not happened because gas engineers, put on their mettle, waked to discover new uses for gas in the home. The American Gas Association now is attempting to develop a refrigerator-furnace capable either of heating or cooling

a house. The secentific fact underlying this apparent paradox is that animonia not household ammonia, of course, which is a solution of ammonia in water—has a boiling point of twenty-seven degrees below zero. Ammonia, circulating in coils, absorbs heat from the air. In cold weather this property will be utilized to absorb sun-heat from outside the house, in summer to absorb heat from within As a theoretical proposition, this sort of furnace-refrigerator is entirely possible, its translation into a practical device is a matter of engineering.

Far from being dry and uninteresting, accence has an intimate, personal connection with the everyday affairs of our lives. Utility, practical application, the satisfyBy KARL VOOGHT

ing of some existing human need—these have always been the results of science and the driving power behind each new scientific achievement.

For years engineers have sought for better methods of building roads. The automobile has multiplied their problems many times. Hundreds of materials have been used, including even blocks of rubber. And now, from Pans, comes a report

Resulutionary Motor

Designed in a new part of a single essence waite out of 4 and the rise end to end the out of 4 to the out of the action of the out o

of an entirely new—and socressful—paving made of blocks of cast iron. Highway engancers there amountee that the iron auriace were less than any other paving and motorate reported that the tiny cracks between the blocks reduced the danger of skidding. The engineers point out that the pavement is constantly protected against rust by oil from motor cars and that the iron cannot be worn into ruts. The experiment will prove especially interesting in England where oil and asphalt, washed into readude streams by rain, are believed to have killed fish.

And no one who ever used the telephone can fail to be interested in this report from London of the invention of a device to record telephone messages. For more than thirty years scientists have tried to develop a practical system of sound reproduction that can be attached to the ordinary instrument so that messages coming in our absence can be saved for us. This London machine reproduces the speaker's voice in full volume and with clarity and accuracy. Such a device will interest particularly doctors, lawyers, and other men who must be away from their offices for long periods.

Seed bars, shaved from the holls of cotton seeds, are being made into nitrated cellulone for the production of explosives, lacquey, and photographic film, according to a recent amounteement of the Du Pont company. Waste wood, unfit for anything else, produces commercial alcohol, cornstalks make paper; "worthless" blast furnace slag is used to make cement. This science produces "magic money" — we alth from the accap me

Service never stands at it. It changes our thing it touches, improves and the reports, coming to this magnification every corner of the world. I hat the number of new words I see, that one day will be in everyday a brief investigation showed me that more than a quarter of a million words.

that the dictionary-makers of 1900 never heard of are in the books today, and the number grows by thousands every year. Possibly the newest is "nemo," which is pure Latin for "no-body". Thus radio broadcasting technicians refer to a stadium, half, or distant studio from which a program is being transmitted to the broadcasting station over a telephone wire as a "nemo station."

Just as new is the word "perminyar," the name of a new metal, the characteristics of which are its high magnetic permeability and the invariability of its behavior under magnetic influence. The name is a compound of the two words "permeable" and "invariable." Perminyar is a compound of iron, nickel, and cobalt.

Behind it is an interesting story beginning several years ago when Dr. G. W. Elmen, of the Bell Telephone Laboratories, discovered that an alloy of iron and nockel in certain proportions and under certain pressures was forty times as responsive to magnetism as pure soft iron, previously regarded as the most magnetic of all substances. That alloy was named "permalloy," and one of its first applications was the "loading" of the high-speed ocean cable between New York and the Azores,

A THIN ribbon of permalloy 7,500 miles long wrapped around the cable core so accelerated the speed of agnals that more than six times as many telegraph messages can be sent in a given

Brief Bits of Fact and Interesting Comment; a New Feature Portraying the Drama of Progress

time as over the old-style cables. Dr Elmen continued his research and found that by adding cobalt to the grou-mekel alloy he had a substance not so magnetic as permalloy but which loses no energy in being magnetized and demagnetized. A modification of permalloy known as mumetal was used in loading the new Western Umon telegraph cable from Newfoundland to England, the first deep-sea cable capable of carrying messages in both directions at once.

NOW, by the use of perminvar, it has been found possible to carry telephone conversation through a cable much greater distances than has been practical heretofore. The telephone cable now being constructed to connect America and Europe will be "loaded" with this new aloy, thus increasing its efficiency and probably cutting the cost of transoceanic communication.

Here a another new word "carboloy. That is the name of a new metal which will cut a screw thread on a glass rod, here a smooth hole in a block of concrete or out poccelain on a lathe, feats which have been regarded as impossible. Unabloloy was developed by Dr. Samuel L.

Hoyt of the General Electric Company and is an alloy of tungsten, curlinde, and cobalt. The hardest cutting tools heretofore in use, alloys of chromium and cobalt, have to be sharpened after being used less than 200 times carbolny tools can be used 11,000 times refore resharpening! Ordinary steel tools are worn down by an emery wheel; carboloy tools wear down the emery. One valuable use already found for carboloy is in cutting composite gears for automobiles, which are built up of molded material with metal inserts.

"Xenon," a word nearly twenty years old but as yet unfamiliar, is the name of one of the six guess which make up the air

we breathe. Four fifths of the air is oxygen, one fifth nitrogen mixed with argon, zenou, krypton, and neon. Argon constitutes about one hundredth of the introgen mixture and the other three together are about one four hundredth of the argon content; so less than one two bundred thousandth part of air in zenou. These rare gases are in demand by attentiate studying the effect of electric charges in a vacuum, studies without which radio and television, for example, would be impossible. Neon lamps give off a brilliant light so penetrating that neon lights are now beginning to be used as aviation beacons, being visible through fogs which

that he has extracted several quarts of zenon from the atmosphere in a single day. With zenon made available in quantities, we can be sure that some way will be found to convert it to human use. One



Muffler for Airplanes

With a new type of number atturbed to the enhance a Norwegian inventor, Bistre Carlen claims at last to have arrived the problem of ellenning the pleplane's over without seriously reducing the power of the motor. Loss of power due to back pressure in mulliers of the type used on automobiles heretofore high made their use in the air impracticable. The photograph above shows the inventor (toperting at installation of high devices

use might be in a fog penetrating device to increase the safety of airplanes.

Science moves its products rapidly from the laboratory into everyday use. Most of us remember when automobiles were called "horseless carriages," when applanes were considered impractical, when radio was unknown. Yet today there are more than 20,000,000 automobiles in the linited States. We no longer marvel at the airplane. There are radio sets in some or ten million homes.

AND today, in addition to military planes, there are over 10,000 licensed commercial planes in use in the United States. In another ten years, there may easily be fifty times as many. When that time comes, the sky will be filled with the sound of engine exhausts and propeller hums unless effective sileneers are developed. Par-sighted actentists in Europe, as well as in America, are working diligently on this problem.

Sidencing the engine is not expecially difficult, and one Norwegian engineer, Bjarre Carlen, working in Berlin, reports the perfection of an invention that silences his motor. His (Continued on page 151)

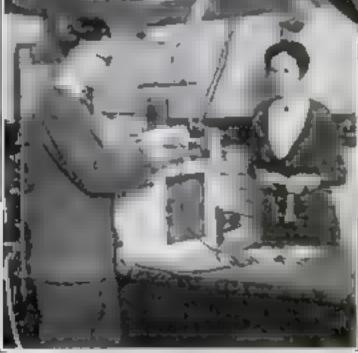


Shroad in hardness only to the diamond, an amoung new metal alloy tougher than steel called "carboloy" is being applied to making cutting tools by the General Electric Company. The metal is made of tongstes, carbide, and cubult, and was developed by Dr. B. L. Hoyt of the General Electric Research Labour the General Electric Research Labour exhibiting a cutter made out of the new material.

concest other lands of light.

Means of extracting neon from the air cheaply, for this purpose, have been found, but the recovery of zenon and krypton is so expensive that the cost of samples for laboratory purposes

ples for laboratory purposes compares with that of radium, a value of almost \$15,000 a quart being placed upon zenon. And now the famous French physicist, Georges Claude, reports to the French Academy of Sciences



Tests Show What Clothes to West

To receive the most benefit from the sun's health-giving ultra-violet rays, you should wear white loosely woven clothing, made of cotton, linen, or rayma rather than wool, according to results of recent U S. Bureso of Standards tests of various cloths with the apparatus shown above.

Strange Fires that Start Themselves

By JOHN E. LODGE

DID you know that an air hubble in a window pane, wet lime, or quied newspapers, may mysteriously set your house after If not, you'll be interested in this story of strange spontaneous conflagrations and of the surprising ways in which they start. It is one of the most amazing stories you have ever read.

ATE one evening not long ago an excited voice came over the telephone wire to the Wichila, kansas, fire department, "I ve been anielling amoke for an bour," said the caller, "but I can t neem to trace where it's coming from " He gave the address of a "Wich ta hotel. In a few minutes the fire truck changed up to the door.

Firemen found that the hotel office and a storeroom behind it were filled with the odor of scorehing paint. Search led to a smoking cloth, saturated with the immutakable order of furniture polish, wadded up and left on the edge of a highly varnished partition. A hole was charred

through it. So hot to the touch was the woodwork benesth it that in another moment it must surely have hurst into flames.

Before he removed the cloth, the firemen's chief summoned all his men to see with their own eyes a typical case of spontaneous combustion— a fire that starts start!

Next morning the porter, when told of his fault, was frankly incredulous. He didn't believe that a fire could start of its own accord. He would not be satisfied until be had taken must her cloth, saturated it with the same polish, and put it in a safe place to see what would happen. In exactly one hour and twenty minutes it was a mass of flames.

Freak blazes have occurred from such a wide variety of sources that it is something of a task to say what will not cause a

their share. Bursting cylinders of compressed, inflammable gas have started fires.

Perhaps the oddest of all involved a tombstone, a box of matches, and a freight car. For shipping, men had placed the grande block apright in a car. As the car passed over a switch the stone swayed

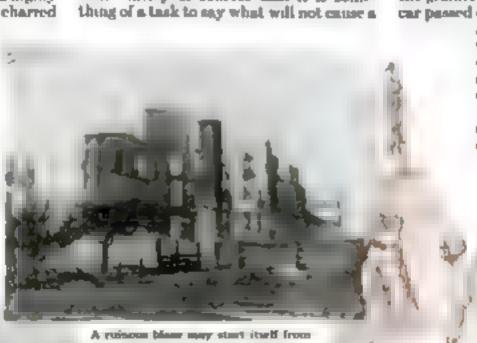
and toppled. Pate decreed that it should alight upon a curton of parlor matches. Soon a merry blass enveloped the car

Alm ont unbelievable, it seems that a steam pipe could set fire to woodwork. Never-

theless there are several well authenticated cases of such blazes. When two teachers and 173 children perished in a fire that destroyed a Collinwood, Ohio, school-bouse some time ago, that blaze was also beheved to have originated where steam jupes passed through the floor. If the air space around them,

required by law, is omitted, after months of baking the abutting wood becomes deed out and reduced to almost pure charcoal. Spontaneous combustion follows, and flames appear at stairway

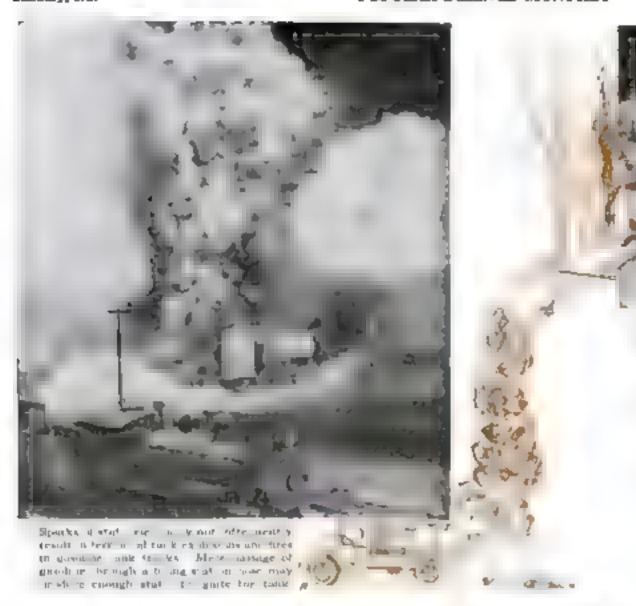
Even an air bubble in a glass window pane can act as a miniature lens or burning glass, fire records show. Sunlight focused in that way on a celluloid comb or other inflammable article has contributed several cases of fire to the records. And the ornamental liquid-filled containers in drug store windows have been known to



A ruisous blass may start itself from to small a thing in an oil-scaked rig

fire. Sunlight will so will dust. Steam pipes have been rare but actual offenders. Nonelectric sparks from buzzing machinery emery wheel sparks fulling into instance—and electric sparks from static electric sparks from static electricity have produced a variety of queer fires equalled only by those that chemicals start. Liquefied glass and molten metal in factories have contributed

Stronge fires in the wake of flend have been traced to heat generates in wet hay.



cause fires by defing as higging glasses. Many a grass fire ban started during a

thumberstorm along a barbed wire fence brashed by tall weeds, from stray sparks rather than direct lightning, As farmers know the electric charge on a metal fence exceed merely by lightning striking near by or by electricity in the air may be sufficient to kill livestock that touch it; and every sparit is a

potential fire menace.

There have been many odd chemical fires. A choice example occurred recently. In a women's hosiery mill in Durham, N. C., they were having tenuble with their bleaching solution. Mill chemists could not trace the cause, and an outside expert was sent for. He arrived on one of the hottest days of the feal | Immediately be wanted to test the bleaching chemicalknown as sod om peroxide—which

was kept carefully, in small tin cans, it the dyn bouse. It was guarded from moisture, because if water struck it a

matter explosion would follow

The expert carned a small quantity to the mill stock room where, surrounded by loose stockings on racin and scattered packing cases, he proceeded to weigh out samples. Beads of perspiration appeared on his brow. There was an ominous sputter as one or two fell upon the chemical be was weighing. Then the box burst into flame and exploded. Fragments of the sputtering chemical flew in every direction, and these exploded again Particles bombarded the entire stock room, and each one burned a hole whereever it lit on a hanging stocking. A packing case, too, eaught fire. Eight hundred dollars' worth of hose had been ruined before the flower were subdued

Perhaps you have seen an alcohol type

piece of sponge platinum that chemically

of pecket eight lighter, in which the igniting element is not a fint but a tiny



bing of the garment produres static which in a lesping upork, ignites the explosive quanting vagor

Btenner 10 William . en staft Bres. A floor pear Attenta, Ga medated a base Micro Centeraling berryle of lane. The staking of the little (mountees) healt enough to start a blace des rice up several bushdings.

Lists the inflammable vapor. One of these in at 1 art Orange, N. J., drug atore gay one clerk an exciting day.

Sunlight focused on a celluloid comb or other inflammable ertirle through an air bubble tens in a window pane, has les as comeny a home to asses

He prepare the refill the lighter from a stock bottle of accohol and, at serti. dedly, puded off the platic carele nect and I ft it on the courter diring the process. Of course the act his bill and a second later the valor site kine pin tage and flushed Feteral fr the clerk, who dropped the bottle and ran, there was little alcohol in it at the time.

When a river near Augusta, Ga. byerflowed its banks some time ago, it elected to mundate the basement of a store in that city that contained several barreis of the slaked lime. Soon the water-sonked limb was slaking merrily, giving off enormous quantities of heat. The fire that fol-

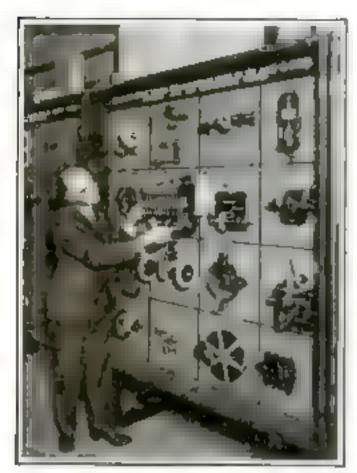
los ! a fire, oddly enough, that water started-burned down that building and several others. There are similar water-hms free on record, One conllagration destroyed a large Connecticut tolucco para. It remained a mystery until an

> investigator found traces of lime that had been soaked by rain beating in through the windows,

> A nanor fire became a scrious one in a New York warebouse, not long ago. when firemen turned streams of water upon an insignificant blaze. The water, penetrat-(Continued on page 15a)



A "Wonderland" of Model Machinery



ARE you familiar with the six simple, fundamental mechanical powers? (and you name them off-hand—the lever, wedge, wheel and sale, pulley, screw, and inclined plane? And how many of their countless modern applications in the home and industry do you think you could list? As many as a hundred? Here is the story of a remarkable man who conceived and applied the idea of making its all better acquainted with the marvels of machinery.

Left The designer and his wonder show W M Clark explains numerous models of an automobile o parts.

> Right Reor view of the automotive acction of the above averating the ratelation which operates the mostels, such of which is our by an electric motor

AFTER years of ingenious labor William M. Clark, a retired loss new man of South Orange N.J. recently completed a unique collection of mustature models of most of the familiar mechanisms used in domestic life and industry today.

The models were designed to educate and inspire young people intereded in modern mechanical contrivances and their history and development.

Mechanics in Clark's hobby. Denied the opportunity to follow a natural mechanical bent when a youth, Clark fell that there quist be bundreds of young men throughout the country facing the danger of a similar frustration of their ambition. To reach as many of them as possible, he constructed his collection in such a way that it could be used as a traveling exhibition. The designer called his exhibit "Mechanical Wonderland, and took it "on the mad". It was recently shown at the Museums of the Pesceful Arta in New York

The exhibit on presents a clear hard acree view of most of the mechanical devices in common use, from ample pulleys to complex steam turbines and gasoline engines, all operated under power. It tomprises 160 models, divided into ten sections, beginning with elemental inschanged forms and progressing to the most introduce machines.

The first five sections show pulleys, came, ratchet inovements, saw devices, foot power devices, ratter are half hearings, belt drives, differential speed devices, and gear condinations.

The second part at devoted to machinery in domestic use. It also common of five sections demonstrating the operation of the doubell new ug machine, pinno, foreact, plumbing, and varie as types of animal wind, and man power devices.

Each section is continued in a boxike frame which is bring on the wall of the exhibition room. Behand each section is an individual motor, operating from the lighting event. In this way any section may be started in stopped independently.

Ingenious Paper Defeats the Check Forger

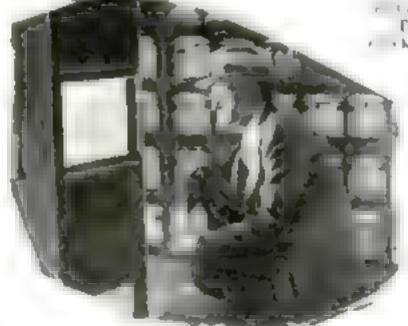
IN A laboratory at Rochester N A Burgess Smith formerly in charge of the anticounterfeiting measures of the L S. Bareau of Engraving and Printing.

has been working for the last ten years to hadle check erromans that now exact an annual tribute of about \$100,000,000 through check forgery and alteration.

Sorth a first step was to discover an ink that would be unde darker, instead of being bleached out, by the apparation of erich cating acid. This done he devised a remarkable processofembodying in check paper a design which tells instantly when a check has been tampered with

Standing beside a camera weighing three tons, and bolding in his hand three glass plater, he explained the new process. On one of the plates the huge camera had photographed thousands of dots spelling hundreds of repetitions of the word "vaid." On each of the other two an intreaste dot pattern had been photographed by the same camera.

Smith placed the two latter plates on top of each other. A design of resettes appeared. He shifted the top plate and the



The detector and its inventor. Chronically treated check papers are examined under light that is, more intense than sunlight.

design changed to one of frost crystam. When the two plates were placed under the third one, the dots forming the "voids" combined with those on the other plates and became invisible. The rosettes or the crystals remained.

The metal plates from which the k paper is printed are exact dople extest of these plates. Smith and,

and the one containing the words - youd' is printed in the special ink. The dots are arcanged in accordance with a secret mathematical (espectably stricting the relative positions of the plates a fraction of an arb, we can get literally thousands of designs all exmouther ig the telltale words 've a. The warning words are and strogar shable until eradicating acids are brought into contact with the paper. Then, the rest of the design fades out and the 'vords,' printed in the ink that it took so long to die cover, leap from their hiding place.

One Man Could Run This Ship!

TEAMING along the Clyde Raver, Scottand, at eleven and a haif knots-thereen land miles an hour a great steamship, which one man could pilot across the ocean, recently passed its trial tests.

Electric controls maneuver the 409foot oil tanker Branswick, largest of its type in the world, now plying between America and Europe, This makes it possible for one mun to direct its every motion simply by pulling levers. In its regular service the ship earnes a crew of

twenty-seven men-

Such a marves of centralized control is made possible by the most modern machinery Instead of turning the single propeller directly, four aix-cylinder Desert engines are coupled to dynamos to suppay a pulsing stream of power harnessed by a switch. It drives a \$,800-borsepower two-piece electric motor coupled to the peopetler

A single lever in the pilot bouse governs the ship's speed, while other levers start. and stop it. A Sperry gyroscope guides the vessel automatically. Push buttom on a panel in the switchhoard room beluw command motors of from one to eighty homepower, to set

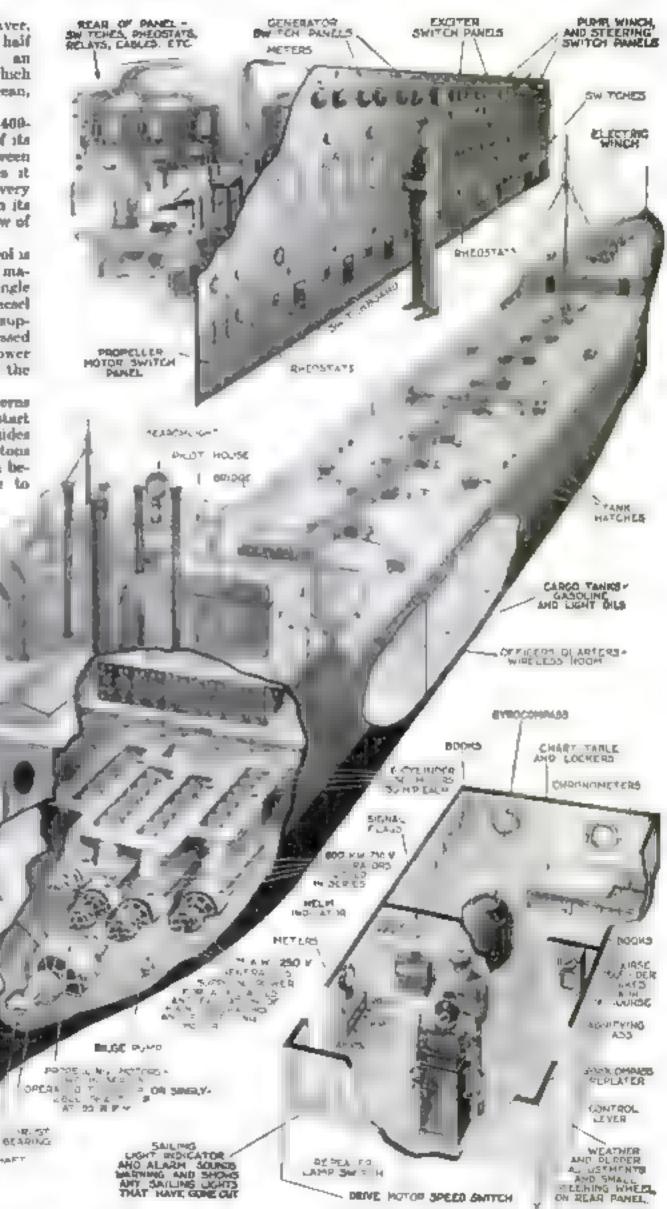
fain, compressurs, winches, and pumps in motion. Indicators in pilot bouse and switchboard room show how the motors are behaving.

AND MESS

My DOWNLIN RUDULA CONTROL -ELECTRICALLY DECATED FROM OVEROCOMPASS

AND PILUT

EMERGENCY



These broken-away views of the huge new oil tanker descentials, her switchbound come (top) and pilot house (right), reveal. the improved electrical and mechanical features which give her remarkable simplicity of control and floribility of operation. The shap's speed is governed by a single control lever in the pilot house, and all movements directed by levers and switches.

SHAPE T



Hourglass, Germ Screen Added to Telephone

NEW equipment for the telephone, shows at an international invention exhibition, held recently in London, England, included a tiny hourglass for checking the time of a long-distance call, and a device for stretching paper over the mouthpiece of a telephone to prevent germs from entering.

The ministure "sand-glass" is attached to the side of the telephone in a holder which permits it to be removed and

inverted each time it used.

The antiseptic paper, pulled from a small roll at the top of the mouthpeer is torn off maly, or after each conversation. The thin sheet does not interfere with sound vibrations of the voice and is expected to provide an effective means of preventing the spread of disease by germs lodging in telephone mouthpieces. The date of the mouth, or advertising matter can be printed upon this paper where it will be in a completious position.

River Suddenly Vanishes for Three Miles

O'ERNIGHT, three nules of a river on Colorado recently disappeared. One Friday night the White River, with its headwater at Trapper's Lake, east of Meeker, was flowing as usual. Saturday mortung, part of the stream had vanished, leaving thousands of dead trout on the dry river bed. Examination showed that the river flowed into a hole in the ground and three nules further on issued from another hole in the inde of a hill, continuing in its regular channel.

The theory is advanced that the stream cut into an underground passage or lake that provided an easier course.

Curious "Rubber Snake" Is pocket clip are part of the equipment. Found in Yellowstone

THE first rubber make ever found in Yellowstone Park was recently discovered by a party of visitors guided along one of the nature trails by a ranger who is also a naturalist.

A member of the family to which the box and the python of the tropics belong, the rubber snake is a northern species and classed as a constrictor. The new inhabitant of Yellowstone, unlike its tropical commis, is barmless. It is even claimed that it will make a faithful and

affectionate pet, for those who like that nort of thing.

The recently found specimen was not more than a foot long and its body was of virtually the same diameter throughout, its tail being blunt like the head. The surface of the body was smooth, and its akin loose-fitting, of a greenish brown color above and a tunnish yelfow beneath. The maximum length attained by the rubber snake is about two feet.

Rat-Eating Rats Bred to War on Their Kind

A "dog cats dog" to the effect that rat devours rat, as being put into practice

at Leningrad, Russia.

To combat a vertable rat epidemic it. the city where it is est mated an army of 2,000,000 of the rodents are menacing public health and destroying approximately \$2,500,000 worth of property annually, a system of self-extermination among the creatures is now in progress.

Rat-enting rate are bred by placing pairs of the ammats in cages and starving

them for a long time. In some cases, one of the pair will attack and cat the other under those conditions.

Then the est-esting rate are paired until, by a process of climination, a number of super rate catting rate are evolved. With these ravenous beasts as the ancestors, breeding of estimula listing rate is thereupon begun

Centers of rat extermination have been established in 220 cooperative stores, misety-or factories ten storehouses, three markets, and thirty eight other establishments.

In these places, the ratesting rat will be let loose to attack his less carmivorous brethren and perhaps the results will be a ratiose Leningrad.

A Pencil and Handy Slide Rule Combined

INSTEAD of chewing the end of a pencil when stumped by a problem in mathematics, the owner of a newly devised writing tool simply pulls on the end, and the pencil becomes a slide rule.

The pencil is refillable, the upper end carrying extra leads. An eraser and a pocket clip are part of the equipment.



Pencil and abde rule in one. The halves of the rule form the main budy of the dovel pencil.

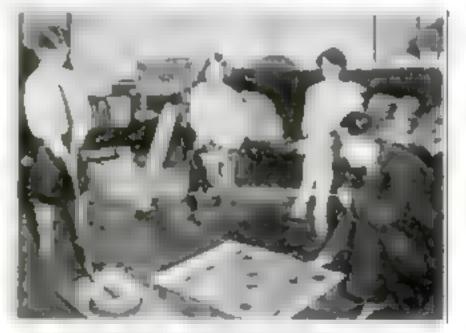
Now Golfers Can Tee Off in the Living Room!

GOLF can be played in the house by means of a new toy which records the strength of drives and putts in yards, and shows the position of each player on a ministure golf course after every stroke. A "300-yard drive" can be made in a space no larger than is required to swing

a golf club, the inventor says.

The game consists of two parts—a chart on which the course is pictured in minuture, and a recording dial with an arm, at the end of which the golf ball is attached. When a player strikes the ball the arm awings around the dial against a heavy coil spring, moving a pointer ahead of it. After every abot, the ball returns to its original position, but the pointer remains at the position on the dial which above the force of the stroke in terms of yards.

The dial is marked off with a graduated scale up to 500 yards. After each stroke, a marking base or counter is moved ahead on the charted 'course' for a distance relatively corresponding to the



Forch When the player "turn off" the strength of his drive is recorded on a dual in turns of yords, and around on a miniature golf pourse.

"drave" recorded on the dal. The toy, says its maker, provides not only entertunment for the whole family but aids the golfer to keep in form during the winter.

Champion Blood Donor Has Given 117 Pints

A REMARKABLE record of bloodgroung has been uncovered by the
French Academy of Medicine. In three
years, a thirty-year-old Frenchman,
named Raymond Bries, gave 117 pints
for transfessors and recently be submitted
to his 264th operation for the purpose.
The previous record for a year was held
by a German who gave thirty pints. An
American, with twenty-eight pints, was a
close second.

Last year, Bries underwent four transfusion operations in twenty-six hours. His only ill effect was a temporary feeling of tiredness. In the case of poor patients, Bries always refuses to accept remineration although he often loses money as well as blood because he has to leave his work at the Paris Central Market to go to the

Complete Fire Department on a Two-Ton Truck

A ONE-MAN fire department, all on a single two-ton track, has been built by Francis E. Ingals, of Guilford, Conn. It carries 1,000 feet of large bose in the body and 200 feet of smaller hose wound on a reel on the roof, as well as an assortment of nozzles and cunnections of various kinds. A 400-gallon pump is mounted on the truck; also a deck gun inpular to those used on fire boats. The latter may be removed from the machine and used some distance away.

Searchlights on the top of the body are designed for floodlighting during night fires. A 110-volt generator and an engage within the body furnish current for the searchlights and also for an electric stove upon which hot coffee is prepared for fire-fighters in winter. Blankets, canvas covers, first-aid cabinets, hand extinguishers, thawing torches, and flores are stored away for emergencies.

This complete fire department was designed by the owner because he wanted additional protection for his country

phia. 2,064.200; Detroit, 1,578.000; and Cleveland, 1,010,300.

An interesting fact revealed by the estimate is that nearly every city in the 30,000 population class has grown since 1920. The report lists 202 American cities having 30,000 population in addition to those on the 1920 list.

The cities which are estimated to have more than half a million population include: St. Louis, Baltimore, Boston, Pittsburgh, San Francisco, Buffalo, Washington, D.C., Milwaukee, No estimate is given for a number of cities, including Los Angeles, which had \$76,075 in 1980, due to unusual conditions of growth.

Elaborate Model Railway Uses Tacks for Spikes

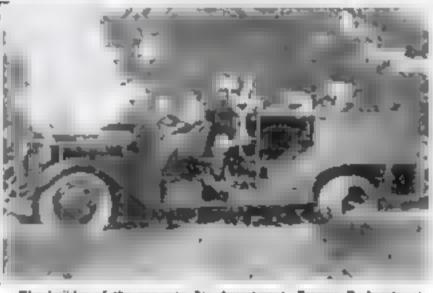
CARPET tacks are used for radroad a spikes in an unusual model radway that occupies most of the front yard of an employee of the Southern Pacific living in Brookings, Ore. A town, a farming district, and a postern highway appear in industrict along the uncety-five feet of two-and-a-quarter-racht gage track over

which two electric locomotives half little trains which include tank cars, flat cars, gondolas loaded with lumber, refrigerator and box cars, stock cars, and cabooes.

Dolla are used to represent railway employees and estuent of the town, which has a school, church, store, hotel, and railway station.

Automobiles and trucks run along the highway and three airpanes are represented as flying over the town. The truck has 190 mile. 1882 tien which have

been boiled in oil to maure long preservation, and \$,864 carpet-tack spikes. Over a small hollow in the yard, a ax-foot trestle is supported by forty-five pues. The entire plat is landscaped with more than \$30 mounture trees.



The builder of the one-can like department. Frances R. Inquis at wheel of his alaborately equipped truck. Note deck goo and fandlights.

home. It is now used to fight fires which overs in the country outside the limits protected by the local fire department. It is the fifth apparatus of the sort which the designer has built,

Door Hanging Simplified by Screwless Hinge

A DOOR hinge that requires no screws has been invented by Chacles A. Genaux, of New York City, to save time and trouble in hanging doors.

Shorting holes are drilled into the edge of the door and into the large side of the door frause, alanting up in the door and down in the frame. It to these holes are inserted metal rods attached diagonally to the hinge, as shown at the right. All that is required to remove the door with such a hange is a slight lift, which disengages the rods from the holes.

Million Mark Passed by Five U. S. Cities

FIVE American cities have a population of 1 000,000 or more, according to latest 1928 Census Bureau est mates. These five leading esties and their estimated populations are: New York, 4,917,500; Chicago, 3,157,400, Philadel-



This model shows how the door, represented by block at the right, in bung on slanting rods.



Hand-Driven Buffer Wheel Polishes the Teeth

A TOOTH polisher, vest pocket mae, is one of the ingemous devices shown at a recent exhibition of inventions held in London, kargland, at which nearly a bundred women inventors displayed models of new ideas. The polisher is operated by means of a plunger, which is pressed by the thumb as illustrated in the photograph. This action spins a rod, on the end of which is attached the polishing wheel.

According to the inventor, the device will permit any person to point and whiten his own teeth at bome.

Indians Had Tooth Ills 3,500 Years Ago

PYORRHEA was campant among the budians in New Mexico as long ago as 1.500 n.c., according to archeologists who have found very ancient skulls in the course of recent explorations in that state. The early red man, the discoveries showed, also suffered from cavities and abscesses.

Dental science is at a loss for an explanation of the prevalence of such disease in such an ancient race. The food of these earliest inhabitants of the American continent consisted chiefly of ment and grains, the same as ours. Cavitics of large dimensions were found in mowors teeth, showing that they were not caused by the wearing down of the teeth through the use of coarse foods.

Studies of the teeth of ancient races, experts believe, may lead to new discoveries of the nature and causes of dental diseases, now only partly understood.

Telephone Calls Triple in European Cities

IN THREE years telephone carls between the nineteen most important cates of Europe have tripled. A record of such calls shows that three people use the phone today where one used it in 1925.

This rapid growth of service in European centers of population is viewed as an aid to communication between continents. The increase in good connections in European countries advances the value of the trans-Atlantic lines that connect Great Britain, France, Germany, Belgium, and Sweden with the United States, Canada, and Cuba.

Philippines Will Witness Sun's Total Eclipse

IF YOU are interested in total echipses of the sun, you might do well to plan to be in Mazula, P. I., on May 9, 1989, when that phenomenon will occur there.

The Hamburg, Germany, Observatory already has made preparations to send a party, and it is expected that several groups from other parts of Europe and also from the United States will follow

According to Father Miguel Seign. S.J. director of the Philippine Weather Bureau and the Manila Observatory, two factors will warrant the time and expense involved in observing the cellipse—first, the probability of clear weather, and second, the docation of the celipse over accessible and convenient points.

The plane of total eclipse extends across the middle islands of the Philippines, the Visayan group, and through the tenth and two th rest of the eleventh degrees of north latitude. The duration of the eclipse over this area will be three annutes fifty-four and a half seconds.

There will be places to Stam and on the idend of Sumatra where the eclipse also may be observed, but the Philippines will be the logical spot for American observers.

California Fishing Fleet Gets \$13,000,000 Haul

TARGELY through the use of scientific La methods. Los Angeles fishermen made a \$13,000,000 catch last year. Most of the haid, taken from the waters off southern California, consusted of sardness and tuna. Some of the vessels were equipped with Diesel engines and refrigeration, and could crosse for hundreds of cules without putting into port. Of the sardness enught, seventy-five per

cent were canned and the remainder were run through a fertilizer plant and converted into fish meal, which is used both as fertilizer and as food for hyestock.

Huge Pylons to Support Greatest Arch Bridge

FROM towering pylons of masonry that would hear the entire weight of the steamship Lerication without crumbling, the world's greatest such bridge, with a central span 1,650 feet long, is being built across Sydney Harbor, Australia. The photograph below shows the main pylon, on the city side of the harbor. On its auminut creeper cranes are being prepared for the task of swinging ponderous steel beams into place over the harbor.

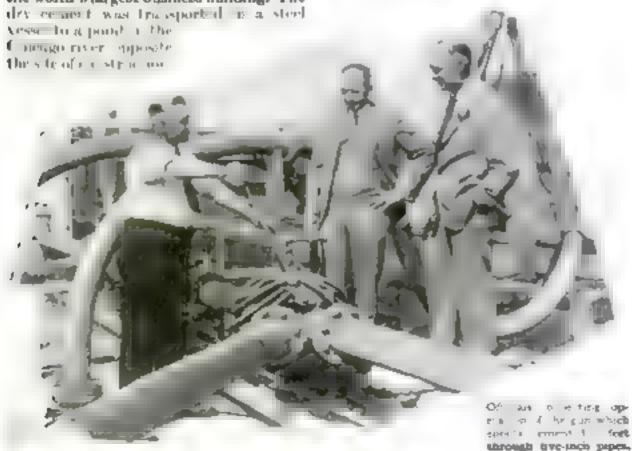


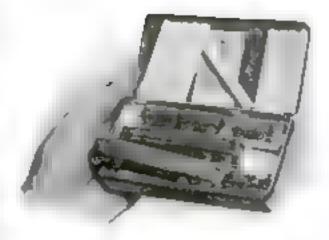
The main pylon of the bridge, showing bugs crance ready to triving start beams toto place.

Air Pressure Gun Shoots Cement 135 Feet

TWO million pounds of cement were shot through five-meh hose seventy-five feet into the air recently when work began on the foundations for the Merchandise Mart in Chicago, designed to be the world stargest business building. The dry secure it was transported in a steel

There a compressed are gun shot the contents of the hoppers in the ship's hold through a hundred and thirty-five feet of pipe and seventy-five feet high into a huge three-story bin on shore





Working Model Train Fits in Cigarette Case

A MODEL train, built to scale and operated by an electric motor housed in the tray engine, is carried around in a cigarette case by the English enthronast who constructed it. It was mult by J Langridge, of the Wimbledon and District Model Ranway Club, and shown at a recent model engineering exhibition.

It is believed to be the smallest working scale model radway train in the world. In every detail it was constructed at a scale ratio of eight hundrest has of an inch to a foot. At its tallest point, the cab of the locomotive, the guniature train is only half an inch high and the track it runs upon in three-eighths inch gage.

The tiny train, with its engine, three coal cars, and two passenger coaches, fits anughy into one side of a cigarette tin designed to hold fifty cigarettes.

Fresh Air One Mile Down

A MILE below the earth's surface, miners working in the copper mines of the Lake Supersor region are supplied with abundant fan-driven fresh air through convex tubing from the mine openings. A recent survey showed that from 40,000 to 100,000 cubic feet of air per minute was circulating through the lower levels of the shaft. Here the rock temperature was ninety degrees F

How Much Do You Know About the Weather?

TEST your knowledge with these questions, chosen from hundreds saked by readers. Correct maswers are on page 1-8

- I. How high are the clouds?
- What is the difference between a burrleane, a cyclone, and a tornado?
- 3. What causes frost?
- What causes a red sky at sunset?
- S. What causes rain?
- 6. What is a exinbow?
- 7 What is the meaning of the lines on a weather map?
- 8 What does a barometer tell about the weather?
- What causes the rings around the moon?
- 10. What is a hygrometer?



It Plays a Tune When You Light a Cigarette

WHEN you lift the lighter of an unsucal smoking set recently placed upon the market, a music box concealed in its base plays a tune. The set, consisting of a sighter a container for eignrettes. and an ash tray, forms a compact accessory for the amoker which, says its anyentor, will proyate entertainment each time a cigarette in lighted.

Timing Wind Speed a Hard Job for Weatherman

HOLDING a stopwatch on the wind is the most difficult job of the U. S. Weather Bureau, according to its chief Prof Chartes F Morvin, An improved anemometer or word measuring instrument, committing of four worst-descent cups mounted on revolving cross arms, has proved an advance over previous matruments of the kind, which lagged it winds up to ten miles an hour, and then progreenwiy recorded speeds shows the actual rate for winds beyond fifteen or twenty unles an hour.

The new matriment gives correct readlugs for high velocities. However, there remains the problem of standard sing the conditions under which records are made in different local ties. The roufs of buildange where the readings are made are sometimes high and sometimes low sometones they are sheltered by taller bond-

Know Your Car

IN ANY automobile engine except the sleeve valve type. the valves are operated by pushrods moved up and down by the carm on the cam shaft. These valves must open and close at peccusely the right time if the motor is to deliver full power. There must be some play or looseness in the mechanism to allow for the expansion and contraction of the parts caused by the heating and cooling of the engine. The designer takes this play into account when he figures the contour of the came.

If the valve adjustments are set too loose the motor will lose power and be notsy. If set too tight, power will be lost, and in add toon the valves will not sent properly and will become burned.

ings and sometimes they are unobstructed on all sides. Before accurate wind records for the whole country can be made, all instruments must be placed at the same height above the ground under number roodstoom, Professor Marvin believen

New Airway Beacon Weighs Nearly a Ton

FINGER of light miles long penetrates the darkness from a new tnillion-candlepower bearon light deargued to guide right flyers along the airways. It is called the largest portable beacon ever built. Its diameter in five feet. and its total weight almost a ton.

It can be tilted up or down, rotated sideways, or transported from place to place on the carnage it is mounted on.



The mammoth portable searchlight, of a million condispower on enhabition to Chicago.

Tigers and Men Fight to a Draw in India

MEN with rifles and togers with claws fought virtually an even battle in India last year, according to statistics of the number of tigers falled by hunters and the number of persons falled by tigers, recently asseed by the Indian government, One thomsand and thirty-three persons were sluin by the beauts while 1,308 tigers were abot or trapped during the twelve months, making a ratio of almost one man for every tager.

During the same period, leopards killed 218 persons, while men retaliated by taking a toll of 4,390 leopards, Suakes are still the greatest danger in India. In 1927, 19,069 people died of make hite. The estimated number of snakes that died at the hand of man during the same period is 57,116. Other beasts lucted, and their human toll, are: erocodiles, 190, wild boars, 85, and elephants, 50.

Yellow and Red Rays Also Vital to Body Growth

ALL the colored rays of sunlight and not merely the asymble altra-violet, or "bealth" rays, are needed tormake

your body grow

That is the conclusion of Dr. Charles Sheard, of the Mayo Clime, Rochester, Minn, who tried rusing two broods of chickens, one in light from which colored window paner removed the red and yeslow eave only, and the other in light with the green and blue rays removed. In both broods the overworked parathyrou glands, which have an important part in converting food into tissue and energy, became abnormally enlarged in an effort to make up the deficiency. Cod liver oil in small doses remedied the trouble.

The model, built precisely to scale and

complete in every detail, is a striking

example of latest methods in architecture,

described in last month's issue, which

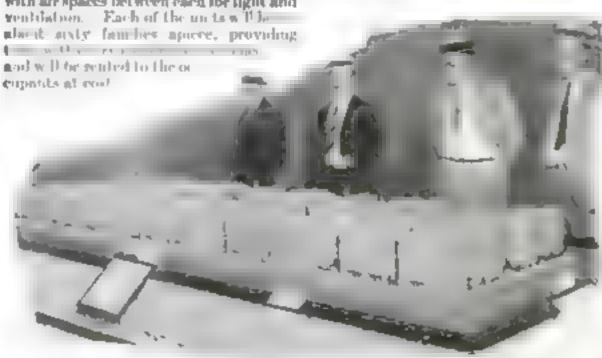
enable a prospertive owner, before con-

struction work begins, to see exactly how

the completed building will appear.

Remarkable Model Shows Apartment Village

HOMES at cost for 625 (number will be provided when a mammath, blockequare group of modern apartment bouses sponsored by Marshall Field, is completed in Chicago. A model of the project, recently exhibited there, shows the tenunits, which will make up the project, with air spaces between each for light and ventuation. Each of the units will be about anty famber apiere, providing the section of the se



This scientific scale model of the projected block of oxedera apartment bosses for Chicago gives a better idea then any maps or drawings of how the dwellings will appear when they are completed.

Hailstones Larger Than Baseballs on Record

TOW big do kailstones grow? A answer this frequently-asked question, the U.S. Weather Bureau has listed some of the historic hadstorius of the past. In 1847, ha betones that measured hisrleen inches in circumference are said to have fallen in New South Wales. Others, weighing four and a half pounds, were reported after a storm at Casorla.

Spate in June, 1829.

Thousands of hombarding halls of ree each as large or larger than a big-league baseball, fell at Dallas, Texas, a couple of years ago, causing nearly haif a in Hum dollars damage. The most meaning report of such a bombardment from the sky came from Cette, France. Here, in October 1844, such hage hadstones are said to have foliets that they weerked dwellings and sunk vessels anchored off

The formation of large hadstones begins at lengths est mated at between 15,000 at d 40,000 feet above the ground.



Pocket Microscope Looks Like Fountain Pen

CLIP off the cap of this little black instrunged that resembles a fountain pen, and you have a powerful pocket microscope ready for action. A slating by Itom on the barrel focuses a surprising vistrong lem, and a tiny narror in the hase supplies. illamination from any near by language w-none. All that is necessary is to rest. the point against a document or object to be examined and focus the lens, and you can see the object magnified many times in the eyepiece. The sliding barrel adjusts the power of magnification.

Plants, Like People, Tanned by Invisible Rays

DLANTS, as well as people, get tanned I from exposure to ultra-violet rays! Thus reports Dr. E. M. Delf, secretary for a committee of English botanists who are carrying on experiments with plants to determine just how they are affected by the inventle rays that sunburn the exposed necks and arms of human bathers at the seashore.

When a plant was exposed to the glare of a quartz mercury vapor arc, recently the surface of the plant turned brown An examination of the "sunburned" plant with a microscope revealed that the change in color had been caused by a breakdown of the outer layer of cells.

New Army "Whippet" Tanks Built for Speed



ARMY tanks that dash over the ground at a speed only slightly below that made by Charlie Paddock when be set the world's record for the hundredyard dash have been successfully tested at Fort Leonard Wood, near Baltimore, Md. On level ground, the new tanks numble along at a twenty-mile-an-bour clip. For splashing through mud, fording streams, or traversing rough country these "whippet" tanks are equipped with a new type of trend which is said to

Tower Thermometer the World's Largest

WHEN citizens of Mumch, Germany, want to see how cold it is, they can poke their beads out of doors and look at what is said to be the world's largest thermometer on the lower of a museum in that city.

The huge instrument, which can be seen for miles, occupies nearly the whole sole of the tower. It was built by a Berlin engineer, Paul Fuent. In spate of its great size, the thermometer is said to record the temperature accurately. Above the thermometer is located a proportionally-large barometer, resembling a huge tower clock,



Comperison with the tiny figure of a mon standing at the Foot of the thermometer gives an idea of the untroutent's bigness.

grip the ground more effectively and to increase speed. Extensive tests of an esperacutal model, covering 1,500 miles, showed that it could climb hills that mecended at an angle of forty-five degrees and could carry sufficient gasoline for an eighty-mile run. A novel feature is that the tank is built on an all-purpose chassis on which can be mounted several different. ntylen of body

The machine is especially designed to carry one man and a machine gun over shell-swept territory with the greatest possible protection. To this end it is built with a law body to offer the least

larget for enemy flee,

Exercise After Meals Not. Harmful, Tests Show

TPSETTING the old belief that exercine after meals as barneful three physicians who have made a series of tests at Guy's Hospital, in London, England, report that moderate excress taken minediately after eating does not returd, and may even aid, digestion. An long as the exercise does not make you nteromfortable, they found, it does not d sturb digestion

Men in thisbeing were found capable of running two miles slowly after a meal without injurious effects. Men not in truning, however, found that an bour a walk was mifferent to hinder digesting. Violent exercise after a meal, say the doctora, results in temporary anemia, or lack of blood, in the moment, due to the amount that is drawn away to the muscles

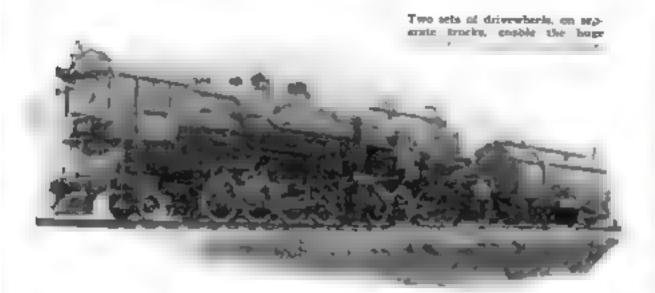
which are being exercised.

Record Blast Displaces 40,000 Tons of Rock

SINGLE blast in a Welsh limestone A quarry recently displaced stone weighing \$0.000 tons from a cliff 100 feet high. It is said to have been the largest limestone quarry blast ever set off in the British Isles. Three and a half tons of high explosives were used in the charge,

Three months had been spent in preparing for the big explosion by sinking sixteen shufts, with an average depth of 110 feet, to contain the explosives, which were set off electrically. The explosion stripped the rock from the cliff and left a smooth surface for future quarrying operations.

Newest Locomolive "Cart before the Horse"



ONGER freight trains will chimb the winding Rocky Mountain tracks when huge freight becomplives of the new est oil-burning type, constructed in the shops of the Southern Pacific Railroad, in Sacramento, Cabii, are put into operation. The design of these great locomotives is revolutionary. Revenuing the usual practice, the engineer's cab is in front and the stack in the rear, making the locomotive appear as if running backward. In addition, the long, ngod body really embodies two separate engines on separate trucks, each operating its own set of driving wheels beneath. This feature of "articulation" increases the locomotive's flemhibty and enables it to swing about sharp curves that an ordinary engine the same length would have difficulty in managing.

The hardest part of the run over the Southern Porific line from Sacramento to Sparks, Nev., will be taken over by the new engines. Their water capacity is 12,000 gallons, as compared with the 9,800 gallons in the locomotives used previously on this run, and the od capacity is increased from 3,112 to 3,771 gallons.

Another fleet of articulated od-burning mountain-chinbers is being built by the Great Northern Railway at a cost of \$110,000 each. They will pull 100-ear freight trains over mountain divisions.

Giant Pump Is Lubricated With Water It Lifts

A SIXTY - THOUSAND - POUND pump that lubricates its bearings with water has been installed at an irrigation well near Firmania. It is attended forms. The grant pump lifts water 640 feet, in a single boost, from the bottom of a 450-foot well to the top of a hill where irrigation ditches carry it away. It is believed to be the highest pressure turbine

pump ever built.

An electric motor of 350 borsepower furnishes the power. Because frequent trouble in oil lubricated pumps has resulted from clogged oil lines and burned-nut bearings, the makers of the Etiwanda equipment had been experimenting for some time with pumps that lubricate themselves with part of the water they raise. In preliminary experiments with small six-men pumps, similar to the one shown at the left of the photograph, water lubrication proved satisfactory. Subsequent tests of the new thirty-ton pump gave convincing proof that bearings of

large one also can be kept in good working condition with nothing but water for a lubricant

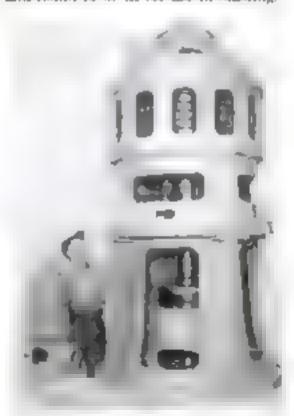
It had been predicted that sand in the water would cause rapid cutting of the bearings, but it was found that the unique design of the bearings of the new pumpeliminated most of this danger, and that any sand that crept into them was washed out before it could cause abranco.

Millions of Tons of War Explosives Put To Use

HOW TN To made for destructive war purposes ended by becoming an aid to industry and agriculture is told a a recent report of the Explosives Division of the Bureau of Mines.

The war ended with 186,000,000 pounds of high explosives on hand in the United States. All of this dangerous supply has been used for blasting and irrigal up. He fore the war T N T had been considered unfit for industrial purposes. The Bureau of Mines carried on experiments and instructed users in the best methods of handling the powerful explanive.

The excellent keeping qualities of TNT were demonstrated recently when a store nearly ten year old was examined and found to be fit for use in blasting.



New thirty tan irrigation pump lubricated with water. Compare its hige use with those of the man and the six noch pump at the left.

Modern Machines Develop Rich Diamond Field

THE long monopoly on d and has which the South African fields have enjoyed is being threatened by the increasing output of the Belgian Congo mines. From a total output of 15,000 carats, in 1918, the production of the Kasai district, the principal Belgian Congo field, has risen to more than 1,000,000 carats. This represents one fifth of the total world production.

The sudden increase in output is due to the use of improved machinery and equipment. The pick and other primitive implements have been superseded by mechanical excavators and washing machines of the latest type. A seventy-mile narrow-gage radway and 4,000 miles of new road have been constructed. The result of the mechanisms of the mines is seen in the present enormous production.

The diamends mixed here are not as large, however, as those of the famous Kombersey fields to the so ith. The Kombersey fields to the world. One dug there diamonds in the world. One dug there recently is said to have weighed 419 carats and was sold at the mixe for \$65,000. When it is cut, its value is expected to be at least \$50,000.



Sandpapering Made Easier by Handy Holder

A NOVEL means for holding sandpaper, emery, or other abrading conternal for bandwork is provided by this newly devised block. On both a least the block are slots into which the ends of the polishing material are inserted. Special clamps are then pressed in as shown in the photograph, holding the material finally in place. Having one sharp and one round edge, the sander is adapted to any shape of most hat. A rounded hanager ponakes it easy to hold

With a polishing cloth firmly stretched over the block, photographers find it useful for polishing ferrotype plates. With a cloth dioped in paraffin, the housewife may use it as a liaturon polisher, which is one of its many uses about the home.

For polishing moldings, pipes, or large round surfaces, another block is supplied with a concave surface.

Begin Search for Radium

CARNEGIE INSTITUTION, Washungton, D. C., is to conduct a worldwide search for radium. In the whole world there has been mined less than four nunces of this valuable substance. Most of it has been found in Colorado, although some has been discovered in Russia and some in Turkestan.



lymon break and the representation of the through the fixing batt the conslepting parais, the hypo takes infinites may test ticles of the sover that found part of t mental we nater coating of the film. 1a nourt from a single film is slight, but at the end of a day the olver redigion has accumulated in the bottom of the fixing Valle Constitution and appropriate

In recent tests or a new chemical procem for reclaiming this silver a five-pound piece of silver, shown in the photograph at the right, was obtained. The large hypo vats of a west coast studio, shown above, give an ules of the size of the fixing batha which have become "silver mines." thanks to the ingenuity of chemists in salvaging precious motal previously

thrown away. Science is controsally discovering new ways. in which to reclaim the waste products of audustry

Patrolman's Club Also Flashlight

APOLICEMAN'S might bludgeon at one end and a flaxlifght at the other has been devised to aid officers when they patrol the dark alleys. The stock is made of steel tubing with threads in the end of the grip, into which a flash lamp is screwed. This urrangement, the inventor says, enables an officer on night duty to throw out m beam of light without waiting to pull a flashlight from his

to keep the club in his hand ready for use. Tucked under the arm with the light directed on a notebook, it leaves both hands free for writing

Flashlight batteries are contained in the grap, and are replaced simply by removing the lamp bulb.

Predicts Water in Place of Coal for Fuel

THE future feel will be water instead of coal, according to Dr. Walter you Hohenau, a Brazilian physicist, who says he has discovered a means of liberating the hydrogen from water. His process, be

explains is the result of years of research. By applying very high frequency vibrations to water, he says he has been able to break it up into its constituent elements of hydrogen and oxygen. The hydrogen, he contends, will be used in puice of coal gas as a feel and will make the mining of coal unnecrosary

When Dr. von Hohenau presented his plan at a recent world fuel conference held in London, the objection was runed by a memher of the conference that the energy required to set up the vibrations, even if they were capable of 1 berating the hydrogen, would offset the energy gamed by its use.

Coconuts May Rival Cows

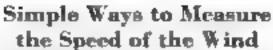
ONS and ecconuts A will become rivals if tests of a new chemical process for making a misk substitute from the fund in ecconuts proves com-

pocket, at the same time permitting him mercially valuable. The mest of the coconut is being used in many ways, but few uses have been discovered for the "milk" within the shell. In Manila, where great factories shred the meat of the fresh nuts, the fluid has little commercial value.

Pressing a button on the

grip of the pobermun's might

Herbert Walker, an American chemist, has just applied for a patent upon a proceas which he says will produce a genuine milk from this fluid by blending it with the liquid from the pressed fresh mest. The result is said to be a rich and wholesome beverage applicable in every way in which midk is used. The resemblance in said to be so close that cream rises to the top; and, when fresh, it foams in the same manner as does real milk from the cow.



SIMPLE guide for judging wind Aspeeds has been worked out by the Forest Section of the U.S. Department of Agriculture. In forest fires, the number of men needed on the fighting line is often in direct proportion to the strength of the wind that is blowing. To help men in the field, who have no matruments to measure the speed of the wind, these rules, which anybody can follow, are given by experts of the Service.

A light wind, up to seven inles an bour, is felt lightly on the face, and rustles

A gentle breeze, eight to twelve miles an hour, keeps leaves and small twigs in constant motion and lifts a light flag.

Moderate winds, th ricen to eighteen oules an hour, raise dust and away small

Fresh winds, nineteen to twenty-four miles an bour, sway small trees in leaf and cause created wavelets to form on inland

Strong wands, twenty-five to thirtyeight miles an hour, whistle through telephone or telegraph wires. One walking against them feels himself being held

A gale thirty nine to fifty-four miles an hour, breaks twigs off trees and often infacts slight atructural damage to build-

A whole gale, fifty-five to seventy-five miles an hour, appools trees. Any word with a velocity of more than seventy-five miles an hour in classed as a hurricane.

This Mail Box Sheds the Water Like a Duck

THE proverbal duck's back in gone one I better by the mail box invented by L. A. Stelhouse, of Baltimore, Md., which sheds most of the rain from its top and directs what little enters by way of the letter slot out through an opening, so the monsture never reaches the letters deposited within.

When mail is deposited in the slot, a metal grul at the top directs it at an angle into the main compartment of the box beyond a partition. This partition eatches the rain that drops from shove into the slot and directs it out the back.



The inventor pours water auto the slot of his near mail box to above that it is rain-proof.

Camera Records Path of Lightning Bolt

FOR the first time in history, the flashing progress of a natural lightning bult on its way to the ground but been recorded in a close-up photograph. The feat was accomplished recently near Lake Wallenpaupack, Pa., by a marvelously high-speed camera, otherwise known as an automatic eathode ray oscillograph. This instrument, somewhat similar to one described in the article "New Magic Worked by Cameras" in the September issue of Portlan Science MONTRLY, was developed in the engineering laboratory of the General Electric Company

records what goes on in meredibly small intervals of ten millionths of a second

At Wadenpaupack, the camera photographed the progress of a lightning salt as it struck a high voltage power transmisstop line. The time which clapsed from the striking of the bolt until the electric pressure of the impact reached 1,500,000 volts was revealed to be five malianths of a second! In another split second the voltage reached 2,500,000 and in another ten policonths of a second it began to drop. From the impact until all effects of the bolt vanished from the camera's eye. forty millionths of a second elapsed,

This camera is more than a laboratory plaything. It is being employed to study the nature of lightning and its effects on

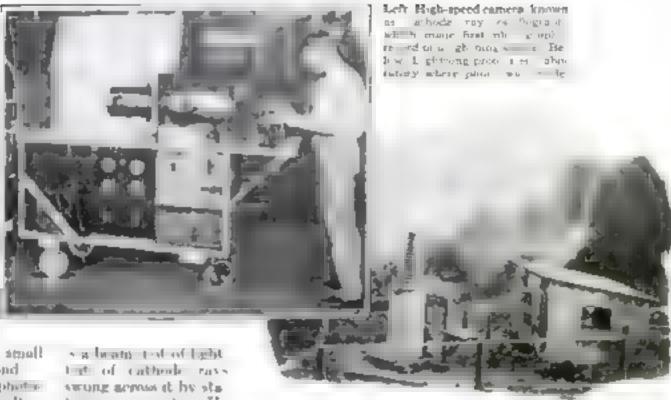
high-tennon power lines.

Invents New Television System Minus Disks

COME television experts believe that while apparatus like spinning disks and synchronized motors are necessary today, television transmitting and receiving sets of tomorrow will have no moving parts. Working along this line, Philo T. Farmeworth, of Provo, Utah, has devised what he claims to be a teles own projector which employs no whiching scanning disk-The receiving acreen, he says, is the conted fluorescent bottom of a glass flask, and the scanning beam that paints the picture



The Inventor with his new television apparatus. Glass object in his right hand contains the receiving screen,



honary magnets, He

clause his invention can transmit twenty pictures a second.

Another improved apparatus, devised by Dr. E. F. W. Alexanderson, one of television's pioneers, exhibits a moving image twelve inches square, as compared with the three-such pictures previously obtained. It uses a sprinning seaming disk studded with lenses.

Tests of Lumber Reveal Why Paint Fails

WOOD has bolen in it, and paint catches in them. If steam find plenty of good-axed holes or pores in the wood

to enter, the paint will attek. Otherwise it will drop off in flakes. There is no inherent atick-to-it tveness about point

That is the conclusion of the Porest Products Laboratory. U. S. Forest Service, after careful tests to find out why paint fals. It found that paint adheres readily

to spring growths of wood, and poorly to summer growths, because the former are and the latter derse and comely poreless. The different behavor of the two kinds of wood above up

sharply when a beard containing both is painted, as illustrated in the accompanying photograph.

Before point will stick to all boards with equal durability. some method must be found, the Laboratory concludes, to make it adhere even to wood with a shortage of large pores.

Toy Sails 1,750 Miles

DURING a recent celebra-tion, Thomas J. Rubino, of Paterson, N. J., sent up a toy halloon with a note attached asking the finder to communicate with him. He received a letter from a man in Albuquerque N M., 1,730 miles away, saying the halloon had been found on his roof.

U. S. Experts Seek Paper That Won't Wear Out

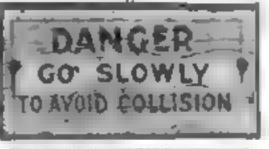
DAPER that won't wear out is being aought by the United States Bureau of Standards in Washington, D. C. As a first step in this direction, experts of the Bureau are testing the different products that are now on the market. These will he put through sorelerated aging experiments in the laboratory by the use of artificial heat and light

Chemical and physical tests will follow to determine the constituents of the vanous papers and their effect upon its wear-

> ing quality. Later, the Bureau will cooperate with manufacfurrer to increase the durantee of their product

An interested obs server of these tests in the American Labrary Association, which has been serking more durable new material for book leaves. Special news-

papers for bound volumes, printed apon a newsperial paper of rag fibers and to se of remarkable durability, have appeared recently in an effort to lengthen the life of dashes preserved in libraries.



on which point has folled. Light portion is spring troud on tritich the point sticks.

Deepest Oil Well Goes Down 7,800 Feet

Tt BE of steel, driven 7 800 feet into the earth, is now bronging of to the surface from what is believed to be the deepest producing well in the world, in the Signal Hill oil field in muthern (a iforma. Experts believe that the success of this new well will lead to the reopening of fields that have been drained by shallow

Operators expect that improved apparatus for drilling will enable them to sink wells as deep as 10,000 feet within the next few years. Already contracts are being signed in the region of Long Beach, Calif., stipulating a certain percent royalty to land owners for wells not deeper than 10,000 feet, and an increased royalty if wells deeper than that are used.

Our New A.C. Set Completed

How to Add Audio Amplification to the Two-Tube Outfit Described Last Month, and Get Loudspeaker Reproduction

By ALFRED P. LANE

IIE four-tube, full electric radio receiver detailed on these pages is the two-tube outfit described last month in Paperan Science Monthly, with the addition of two stages of audio amplification to get budspeaker operation on most stations.

A B-climinator has been added. This can be either a factory built unit or a home assembled outfit.

In connection with previous articles describing that receiver as its simpler forms, many readers have man red concerning the relative ments of the receiver fitted with ping-in code or with simple, home-would code.

When fitted with the plug-inents as shown here, it is a combination short and long wave receiver. As a short-wave set it is used with three tubes, since the radio-frequency stage is of no use on the short waves. The

plug-in code on the broadcast hands give particularly good selectivity at some sacrifice of distance-petting ability. If your interest is mainly in the short waves, and you wish to tune the broadcast bands merely for the programs of local and semi-distant stations, then the plug-in code are recommended.

If, on the other hand, you care nothing about the short waves and you want maximum results on the broadcast band, you will do well to build the set with plain, hand-wound cods.

If you have built the two-tube receiver described last month, the cost of completing it according to the directions here given will amount to the proce of two audio-frequency transformers, one output transformers, and a loudspeaker. Of course, two more tubes will be required; one type \$26

For the convenience of those who have already completed the set in either one- or two-tube form we list the parts separately.

and one type 171A.

These parts are in the one-tube

A1, B1, C1—short-wave coil act, including extra coils to cover the broadcast band of wave lengths.

D1 — variable condenser, .00014

pifd, espacity.

D3—grid condenser, .0001 mfd,

capacity with clips.

D3—fixed condenser, .0005 mfd.
capacity

E1—radio frequency choke coil, 85 milliberries inductance.

F1 grid leak, 5 megohns.

F3—variable resistance, 9 to 5,000.000 ohns.

GI socket for heater type 227 vacuum tube.

These parts were added to make it a two-tube art:

A2, B2, C2-mounting and broadcast

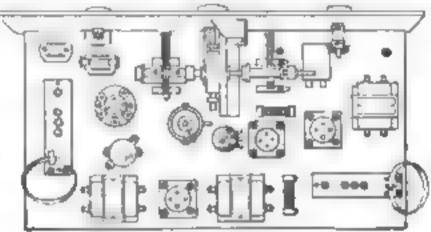


Fig. 1. This diagram shows how to place the parts on the basebourd. You can judge positions by eye messurement.

band costs (or home-wound coil).

D4-warrable condenser, .00014 mfd. capacity.

Da -midget variable condenser.

Dif-hypust condenser, 34 mfd, capacity.

Firesix-ahm potentiometer.

F4-2,000-ohm fixed resistance,

GJ-standard X-type vacuum tube socket.

H -oscillation controller.

And now you need these parts to add audio amplification:

√1. J2—high grade audio transformers.

J3-output transformer.

Gl. G1-standard X-type tube sockets.

F5-One-thousand-obm fixed resistance.

You will need all of the above parts if you are just starting to construct a receiver and in addition you will, of course,

Drum that panel 7 by \$1 mehes, baseboard \$4 by 10 by \$0 mehes, wire, screws,

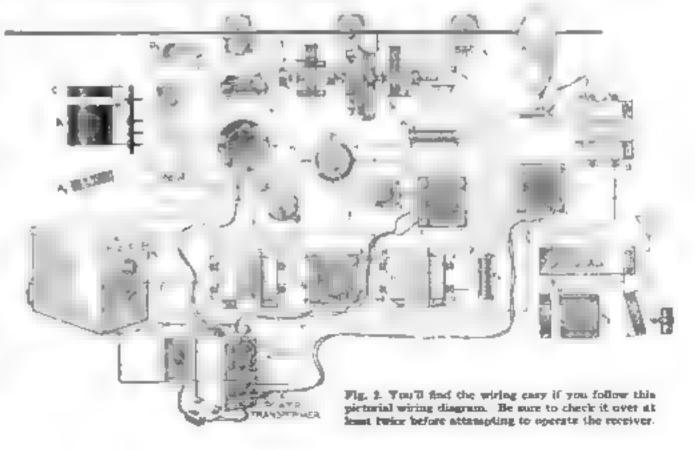
etc. as well as an A power transformer, a good B-et minator, and a londspeaker

ASSHOWN here, the receiver at Amodern in appearance, Some readers, however, have asked whether they can use two ordinary timing dials amtend of the drum dial. This is entirely practical. Of course, if you have independent control of the two condensers, you will not require the midget versior condenser D6.

This midget condenser is, however, absolutely necessary if you use the single dial control, because of the effect of the an-

tenna on the tuning of the radio-frequency stage.

Please pay particular attention to the location of the fixed resistances F4 and F5. In the two-tube circuit shown last month, the 2,000-ohin resistance F4 was used to supply the necessary C-bias for the radio-frequency stage of amplification. In the circuit shown in Figs. 2 and 3 you will note that the new resistance you have purchased, the 1,000-ohin resistance F5, is located where F4 was connected, and F4 is moved over to act as a grid-biasing resistance for the power





Testing the new full electric. four-tube receiver in the laboratary of the Popular Science Itself tule of Standards. It was found to be efficient and modern.

A view of the completed receiver from above aboving the layout of parts and suring Before brainbing construction of the set, study this photograph, as well to Fat. L.

OPULAR

MONTHLY Blue-

print No. 99, de-

scribing in still

greater detail the

construction of this

modern and easily

built four-tube full electric radio re-

ceiver, may be obtained for twenty-

A complete list of parts approved

by the Popular Science Institute of

Standards for use in constructing

the receiver will be mailed with each

blueprint or sent free to readers who

wish to work from this article. Ad-

dress requests for advice or informa-

tion to: Technical Editor.

five cents (see page 105).

SCIENCE

tube type 171A in the last audio stage. The reason for this change in that in the four-tube circuit, the first nadio stage is binsed by the same resistance as is used in the radio stage, which means that the resustance must be dropped to half the value, since there will be twice as

much current flowing through 1. Substituting F5 for F4 is the only change in the wiring of the two-tube circuit required when you add the parts to complete the

met.

Follow Fig. 1 and the photographs on this page when you arrange the parts on the baselmard. Accuracy is not required. Merely place them by eye measurement. The drum dial should be mounted on the panel according to the instructions of the manufacturer

Make sure that you set the various parts with the terminals pointing in the direction indicated in Fig. 4. the picture wiring diagram. This is especially important for the tube rockets and the audio transformers

Note that no binding posts are used. Since the receiver will be permanently connected with the A-transformer, the B-eliminator. and the soudspeaker you wid find that bringing out loose wires as shown will save the expense of binding posts and the trouble of fitting them

Even the loudspeaker ered tips can be elamped directly to the output banding posts of transformer J i, a though if you prefer, a jack can be mounted on the panel directly to front of it

You will find that the wiring is easy if you follow the picture wiring diagram. of Fig. 2. He sure to check it at least twice before you attempt to operate the

blament beating transformer. If you have any

the proper terminals of the reason to suspect that the line voltage in voor neighbothook is a list high you may find it worthwhile to rut down the voltages in these error to. This applies particularly to the 14-volt erent since the \-power transformers are

designed to handle an type \$20 tubes, and you use only two of them in this set. Consequently the voltage is likely to be somewhat high anyhow. The simplest way is cut down the visitage is to wind ten or twenty feet of ordinary bell wire on a small spool, winding half one way and half the other. Connect this in the 134-volt circuit at any convenient point near the transformer. Reduce the length of wire if you notice any material falling off in votume.

Any high grade B-eliminator, either factory built or home assembled, will give excellent results. It should deover a maximum of at least \$20 volts.

if you want to get full power out of the 171A tube in socket 64. This tube will handle up to 180 volts applied to the plate, and the C-bas voltage of 40 st subtracted from the voltage delivered by the chiminotor.

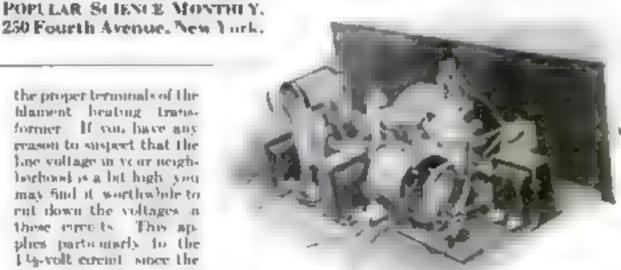
In the case of the A-power transformer,

a socket is provided into which you can meert the plug from the B-eliminator. By this method all the current for operating the set is taken through the plug connected with the A-power transformer. You can turn the set on and off by inserting the A-power transformer plug in and pulling it out of the wall meket or you can Bt a drop cord awatch, as shown in Fig. 2.

The small, mx-volt light that illuminates the dial should be wared by a twisted pair of wires directly to the F terminals of socket 64. This light will then be turned on and off automatical v

After all the connections have been made according to Fig. 1, put the tubes in the sockets. Place a 227 tube in socket (7) a 220 tube to sockets 6 and 64,

(Continued on page 1 st,



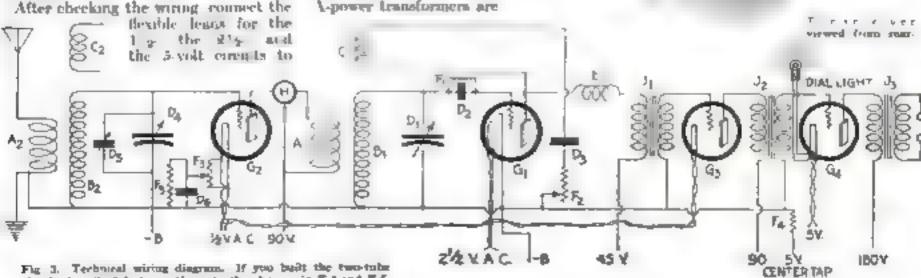
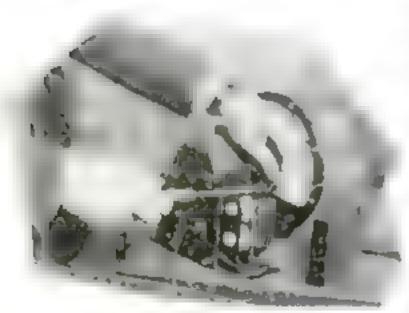


Fig. 3. Technical wiring diagram. If you built the two-tube circuit described last month, note the changes in F4 and F5.

Useful Hints for the Radio Fan

How to Kill the "Dynamic" Hum



Noise Trouble with New A.C. Type Speakers Easily Remedied Better Volume Control with A-Eliminator



Fig. 1. Connecting a condenser across tremitals of magnet colworlding tells been in the speaker.

NAMIC cone speakers require a supply of direct current to energize the powerful electromagnet which seems to be an undespensable part of these instruments. Three different methods are employed to obtain the necessary current. The simplest is to make the winding autable for use on six volts and connect it to the storage battery that supplies the filament current to the recover.

The method of course, is ideal when a dynamic come speaker is used with a battery set, but it won't work with the new electric sets because no battery current is available.

For electric sets, therefore, the dynamic consupeakers are made in two forms. One has a high-voltage winding through which the B-supply current of the circuit can be forced to obtain the required magnet energisation. The other and more common type uses a separate step-down transformer and rectifier element. This latter type is most popular because it can be hooked to any electric set without changes in the internal wiring of the receives.

There is, however, one trouble with the so called A. C. type dynamic speaker. The rectifier circuit is somewhat rudimentary and with certain high quality radio receivers will develop a noticeable hum.

FORTUNATELY this hum can be eliminated entirely in a simple manner. Fig. 1 shows it being done. Merely connect the terminals of a condenser, having a capacity of 2 000 or more increfarads, directly across the terminals of the magnet coil winsing. Condensers of this type are available at reasonable prices. They are used in the assembly of a eliminators and are, of course, only suitable for use on low-voltage executs.

Locating the proper wires to which the connections must be made is simple. A check-up will show that there are wires leading from the step-down transformer to the rectifying element, and there all ways are two wires leading from terminals.

on the rectifying element into a hole in the round case that houses the electromagnet. Connect the condenser across these same terminals.

Wore Durable Tubes

Will a the alternating current tubes, types \$65 and \$27, were placed on the market, they were rated for one and one half and two and one half volts, respectively. These voltages, of course, had been determined with scientific precision by the laboratory engineers who developed the tubes. Extended tests had proved that the tubes gave maximum results with these voltages and they had a normal service life.

But as frequently happens when practical expenses steps in to check theoretical results, the first years use of these tubes in radio receivers brought out some points that the laboratory experts hade t given aufferent consideration.

Taker may last for a thousand bours if fed with exactly two and a half volts, but uniform voltages don't flow from the electric light wires. The voltage fluctuates up and down and the result has been that a great many takes gave out long before their appointed time.

Further development of the 226 and 227 tubes has resulted in a solution of this problem. The tubes now being sold have beaver elements so that they will safely stand any ordinary line voltage fluctuations.

Better Volume Control

A PECULIAR situation has developed with regard to the use of modern types of A-climinators. You may install one of these pieces of apparatus to run the receiver formerly operated with a storage A-battery. The outfit will prove satisfactory except in one way. You may notice that while distant stations are received about as usual, powerful local stations may fade in and out mystemously. The A-climinator is indirectly responsible.

The usual method of volume control on all good battery sets is to fit a rheostat in one or more of the radio-frequency stages and use it to turn down the radiofrequency amplifier tubes when it is desired to decrease the volume. This adjustment is quite critical, and when you use an A battery eliminator the alight fluctuations in the line current voltage are reflected in the output of the instrument and the amplification of the tubes is, in consequence, greatly affected,

The remedy is to metall another type of volume control, as shown in Fig. 2.

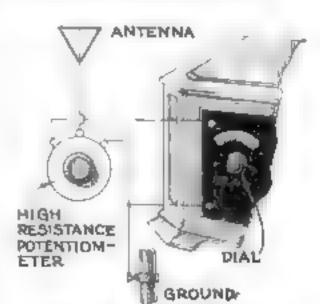


Fig. 2. A simple potentiometer volume control for cadio receiving sets using A-eliminators.

A B C's of Radio

THE A-current supplied to a vacuum tube, either of the battery type or the newer alternating current type, is used to heat either the filument or the electron-emitting cathode.

Compared with the battery tube, the alternating current at tube obtains its A-current at less expense than does the battery tube. In consequence, the alternating current tubes are designed for a relatively beavy A-current. And by still further increasing the A-current, an otherwise poorly designed tube can be made to give a creditable showing.

Many makers of inferior tubes resort to this method of getting results. The use of such inferior alternating current tubes will cause trouble.

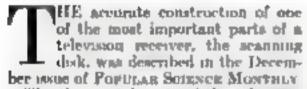
Your First Television Set

How You Can Build and Operate au Amateur Experimental Apparatus Hooked to Your Radio Receiver

By

JOHN CARR

Advesting speed of scauning disk with a tachometer or speed indesirar in Popular Scence Institute laboratory



The three vital parts of the television receiver are the scanning dak, the neon tube, and the motor that cutates the dock. There is, of course the radio receiver but this is not distinctively television equipment, because it differs in no essential from any really high-class radio broadcast recent cer-

The other parts of the television equipment are merely accessories designed to asset in the proper functioning of the

important parts.

You must have a high-grade radio receiver to get saturfactory results in televising. This means that the receiver must bring in the station with plenty of volume whether you are receiving on the broadeast or the short-wave band. Furthermore the mulio amplifier of the receiver must amplify without serious distortion all audso frequencies, from the lowest commonly used in the broadcasting of music or speech, up to at least \$.000 vibrations per second. This range will give fair results. On some of the television broadcasting, even better results will be obtained with a receiver that will amplify up to 18,000.

A variable speed motor in an absolute necessity, for you must be able to rotate your scanning disk at a speed which will be exactly in step with the scanning disk used in the television beaudeasting station.

THIS matter of obtaining synchronism I is the most difficult problem at present. There is no method available for amateur use that does not require constant and extremely exceful hand adjustment all the time the vision is being received. The sughtest error will throw the vision into a chaotic blur of dots and etreaks.

In the Popular Science Institute of Standards laboratory we have found that the simplest and most accurate way to get synchronism is to adjust the motor rheostat so that the disk will run slightly laster than is required. Then we rest a hand in a comfortably supported position close to the edge of the disk and lightly

touch the use of the disk close to the run with the ball of the thumb. The alight friction retards the disk until it strikes synchronium and it is held in step by varying the touch of the thumb-

That sounds like a rather crude system. but it works. With astonishingly little practice you will be able to hold the vision in the frame or picture space which, of course, is so front of the plate of the neon tube

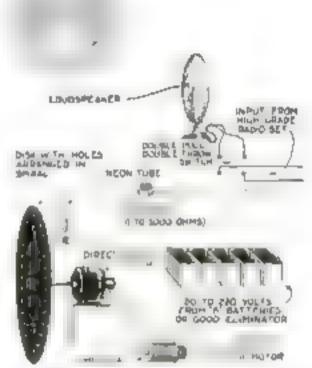
WilEN the image is being perfectly received it is stationary in the frame As the disk starts to rotate either too fast or too slow, the stange will lean in one direction or the other and will start to drift out of the frame. You mereuse or decrease your thumb pressure accordingly. and bring it back.

The illustrations show a typical amoteur experimenter's television apparatus as set up in the Popular Science Institute laboratory. At the top of the page a tachometer, or speed indicator, is shown being used to adjust the disk speed. If you haven't such an motrument you will have to experiment until you hit on the right speed.

There are no special rules for setting up the neon lamp except to get it as close as practicable to the back of the television disk, with the side of the plate that glows squarely toward the disk. To adjust the neon tube voltage, samply turn

the adjustable resistance until the tube

Rear view of the typical experimenter's television. apparatus as set up in the Popular Science Institute laboratory, showing usual arrangement of the parts.



This periorial wiring diagram shows to deted how to hook up the television opporatus.

glows steadily but as faintly as possible Directions as to the proper tube voltage are packed in the box with the tube.

THE diagram on this page shows the wieng. You must, of course, see that the radio receiver is fitted with an output transformer. No worth while results can be obtained unless you use at least a type 171A tube in the last stage of the set and operate it with 160 volts on the plate. Better results are obtained if a st. Il more powerful amplifier is used.

Television receiving must be done to a darkened room. The image is not strong enough to be seen if the room is flooded with daylight. A ground glass in front of the scanning disk also cuts down the light and can be used only with a powerful receiver. The ground glass is not a

> necessity however, as you see the voion just as well by looking directly at the plate of the neon tobe through the hoses of the scanning disk.

> When you first receive a vision you are just as likely to have it upside down as right side up. If it is upside down, take the scanning disk off the motor shaft and turn it the other side to. The image will then be seen right aide up. The image also may be wrong aide to. This is of no particular importance on faces or ordinary objects, but it will make type read backward. To cure

I antimust on page 153;

Parachutes Have Snatched 115 Flyers from Death

NINETY SIX sarmen in America bave saved themselves from certain death by leaping from disabled planes and tristing to their parachutes. In foreign countries, nineteen flyers have done the same, says a recent announcement of the U.S. War Department.

Colonel Charles A. Lindbergh holds the record for the number of leaps from disabled much see, having jumped four times. The first airmen to use parachutes in an emergency to save their lives are said to be John Boettser, pilot, and Henry Wacker, chief mechanic, of the American dirigible, "The Wing-Foot Express, While crussing over Chicago, in 1910, this balloon harst into flances and crashed through the skylight of the Hanous Trust and Savings Bank, resulting in the death of thirteen workers in that building

According to the records of the U.S. Army Air Corps, there is no instance of the Army type parachute failing to open. once the jumper cleared the plane.

Gas Taxes Build Roads

MORE than two hundred million dol-lars were added to the price of gameline in the form of "gas" tax last year. The tax, totaling \$258,986,851 for the whole enuntry, was levied in all of the states except two. New York and Massa-chusetts. The lax ranged from two to five cents a gallon. Most of the receipts went for new roads or for completing payment on highways already built

Largest Grindstone Is Built in Sections

GRINDSTONE for a guant to turn is the one recently exhibited at a machine tool and engineering exposition in England. The huge abrasive wheel, and to be the largest ever constructed, will do the granding of tools in an English machine shop. It is six feet in diameter and fourteen inches thick. The wheel is not a solid piece of atone, but consists instead of some twenty-four small alwasive

stones, each cut somewhat in the shape of the keystone of an arch, and all joined about a large central bub to form the continuous abrauve surface of the wheels. The joints where these smaller sections meet may be seen in the accompanying photograph.

An interesting fact in connection with the wheel is that the stone of which it is made was sent to England from Massa-

chusetta by an American firm.



TELEGRAMS from the local weather hareautecently guided labling a bridge as room the Rue Grande at Brownsville, Texas, Information about conditions upstream during a threatened flood enabled the brige handem to plan each day'n work and to strengthen a a sexwork galong supporting the man structure in time to save the work who are a ready comparison



Huge Domes Strengthen New Coolidge Dam

RECENT completion of three hige concrete dome-shaped buttresses marked one of the final steps in the construction of the \$10,000,000 Coolidge Dam on the Com River, east of Phoenix. Arsona These domes, said to be the largest in the world, are designed to give the dam a maximum strength with remiomy of material. They distribute the

y s a 2 A humber of to at the rest of Di out, the dam will proceed to r here'll be remarke 1 or en acce. a Arcsion, half of which is owned by the Paga Indians, whose ancestors used artificial irrigation 400 years ago.



The concrete domes of the \$10,000,000 Cookings traigntion dom, remains completions. Thus is the first multiple dome dam ever constructed. Its impounded waters will urigate 100,000 acres.

Handy Shaving Lamp Moves Around the Mirror

LIGHT that slides in a groove about A three sides of a mirror is one of the latest aids to scuving. Instead of dodging from side to side to get different portions of his face in the light a shaver to ug the new maror amply shifts the light an or down or to one side or the other as he progresses with his shaving.

The lamp socket is mounted on a movable arm shiding in the mirror slot. Priction clamps hold it in place after it has been moved. All the winng is concealed within the marror.

Your Choice of 765 Cars

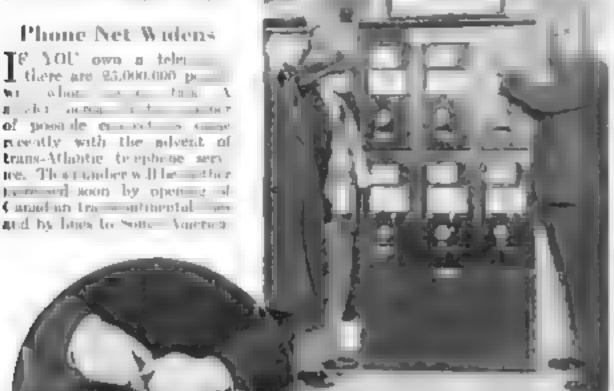
WHEN you buy a new car, you may take your pick from 765 types of automobiles manufactured in the 1 n ted States. Recent statistics reveal that many distinct models of cars are being made in this country. Instead of becomour more standardized, the styles in automobiles that year have a greater range than ever before. Prices of the various models range from \$385 to \$12,500.

Post Office Tries Mechanical Stamp Clerks

EXPERIMENTING with methods of customers at the stamp windows, officials of the main post office in New York recently installed several commutate-slot stamp vending machines in the lobby. The machines sell stamps at their face value with the insertion of the correct change and the turn of a crank, hack machine of any units, sells one-cent, two-cent

and five-cent stamps, as well as books of stamps, stamped envelopes, and post cards, Stamps in larger denominations or in large quantities still will be sold by election.

If postal officials consider the machines a success, they may be installed in post offices in other large cities. Not the least of their advantages, officials say, is that they will permit the purchase of stamps on Sundays or holidays when stamp windows are closed



Twelve-Foot Pie Hauled to Oven by Tractors

AN APPLE pie with a 600-pound lower crust and containing 100 bushels of apples was cooked recently at Albion, N. Y. Two tractions were required to haid this one-ton cabinary masterpiece along small rails rate a specially-half oven. When the balf-inch thick crust was recled on a long steel rod and carried to the huge pie tin, four men strained under its weight. It contained almost 400 pounds of flour and more than 200 pounds of shortening.

After cooking for nearly twelve hours, the champion me, twelve feet in diameter and eight inches thick, was done to a turn. Nearly half a day was taken in cutting and distributing pieces of the piece to crowds at the fair where the unique debracy was cooked.

Living Human Cells "Act" on Movie Screen

MOVIES will play an important part in the medical education of the future according to scientists who attended the twenty-much an ual meeting of the American Roentgen Society, held recently in Kansas City, Mo.

A feature of the meeting was the propetion of a moving picture of I ving tissues, showing just what happens to the relia of the body and to cancer cells when radians a applied.

The film inside by Dr. H. G. Cant., of London Lagand vias shown by Dr. A. H. Pine of Montreat Canada president of the American Roentgen Society

New Tool Invented to Cut Curves in Wood

THE often difficult task of chaping delicate curves in wood, as in making curved legs for tables and chairs, has been amprified by the invention of this new draw plane.

Resembling a spokeshave, it has an adjustable blade which the worker can set to cut the curve be desires. With a little practice, the inventor anya, any amateur woodworker can use the new tool to replace the several tools ordinarily required for such work

Buttons, Combs, and Pens from Skim Milk

WHEN you button your shirt, combyour bair, or sign your name with a fountain pen, you give little thought to sain milk. Yet, says Dr. G. E. Holm, head chemist of the Bireau of Dairy Industry, I. S. Department of Agriculture, shim mak played an important part in producing the buttom, comb, and fountain pen.

Chemists are now using casein, one of the constituents of milk, to produce synthetic ivery and substitutes for born, abony, pearl, amber, and tortous shells.

Strong Men Lose Tug of War with Magnet

ONE of the strangest of high war baged at an industrial plant in it less tagedes. Calif. the other day, when we professional strong men patied their strength against the powerful magnet of an electric erange.

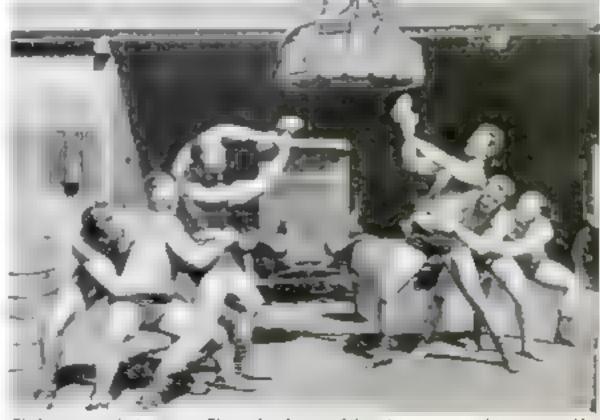
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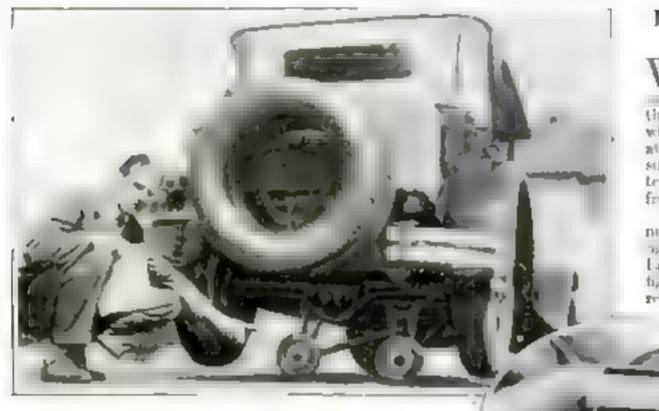
The nicit were in two teams of three men each. The leader of each team lies?

a flateon at arms length toward the magnet. Then, when the electric current was turned on, he and his team mates treed to prevent the group from being drawn to the magnet,

The magnet won against both teams. The largest magnets of this kind can left more time array thousand pounds of steel.



The beginning or he tag or war. The probined power of three strong men on each cean was anothe to reset the tarride pull exerted by the crane a electromagnet on the fishings held by the leaders.



Rollers Park the Car Sideways

I NSTEAD of backing and twisting to get into a parking space, the driver of a car on apped with the latest parking device merely has to head into a vacant place, pull a lever, and the rear of the machine rises and swings around to the curb. It requires little more parking room than the length of the car, according to the inventors.

The lever lowers two augiliary wheels seen under the rear acle at the same time. Ifting the rear wheels of the ear from the ground. Power is applied to the auxiliary wheels from the motor to move the rear of the car adeways. When the driver wishes to leave, he reverses the process, swing by out the rear of the machine. Then he lowers the rear wheels and bucks into the street. The device was made by Claston Walker and his san Bruce, of Piedmont, Cabferna.

A similar invertion was beneget out a year ago by a Baltimore engineer,

Motor Fuel Is Made from Alcohol and Water

A NEW motor fuel, described as a chemical combination of alcohol and water, is said to have given remarkable results in Switzerland, where it was invented recently. Costing one thin as much as gasoline, it is reported to give twenty percent more efficiency is motors and to game complete combistion leaving no residue in the cylinder.

An artomobile using the new fiel won a recent European hall climbers contest, while a motorcycle carried all best prize in a speed race. Details of the new motor fuel are enrefully guarded by the Swiss company producing it.

World's Longest Railroad

THE recent acquirement of admittonal lines in Knasas and Texas is said to have made the Santa Fe the world's longest radroad, slightly exceeding its nearest indeage rival, the Southern Pacific System, which has 13,165 miles of track. Other long lines in the United States include the Pennsylvania Radroad, 10,527 miles, and the Chicago, Milwaukee, and St. Paul Radway, 11,195 miles.

Vitor P. Williams and described at the time in Populace Scale E. Villa His device lated both front and rear

wheels from the

ground and enabled the car to run adeways as far as was desired. In a test, the machine did asdeways into a parking space less than two inches longer than the car strelf, without touching other parked machines.

finall off mileage register attached to the

car's devisioned by rubber suction out.

Oil Cup Invented to Stop Battery Corrosion

A SIMPLE yet ingentous new device designed to prevent corruston of automobile storage battery terminals consists of a small oil reservoir made of lead, with a coplike projection at one aids, into which a felt washer lits. The terminal clamp holds both the washer and the oil receptable firmly in place.

Every few weeks is little oil is squirted into the reservoir, as shown below. The felt alsochs the oil and keeps the terminal coated with a film which prevents acid from altacking it. The device has proved successful in tests covering more than a year according to its inventor, James F. Anderson, of Akron Olito.

Above the glass to a second substitute to the second substitute to the

Dashboard Register Keeps Oil Mileage Record

While N did you last change the oil in our crank case? Unless you are an assault natorist, you will have to guess the answer. But with a new device, which resembles a toy speedometer and attaches to the dashboard with a rubber section cup, the inventor says you can tell exactly when your motor needs a fresh supply of oil

When you change oil, you set the numbers on the deal of the device at the numbers on the deal of the device at the registered by the speedometer. Lat the set of drive, the speedometer factor are as while that on the device remains stationary. A comparison be-

tween the two will tell how many miles have been driven with the old oil

New Highways for Brazil

FOR the first time thousand-mile automobile trip in possible in Brazil, so-cording to G. M. de Menesca, representative from that country at the recent

meeting of the Highway Education Board in Washington. A new highway connecting Roo de Janeiro with Son Paulo makes such a trip possible for motorists. It also makes a drive between the Brasilian capital and Montevideo, the capital of Cruguay, a safe trip with only a single stretch of eighty miles unou-proved. For this distance the automobiles run along the amouth ocean beach.

In Brazil, additional trunk lines are planned, leading to this main highway Two such roads, totaling 400 miles, recently have been completed

Proposes "Smoke Rings" to Prevent Hurricanes

SHOOTING smoke rings thousands of feet into the air from twenty or there's hundred foot steel cones scattered over southern Florida and the Bahama Islands, is the unusual method of preventing West Indian hurricanes suggested by Prof. William S. Franklin, physicist of the Massachusetts Institute of Technology

In each of the cones, a ton or more of the dec would be set off, the resulting explosion sending up a gigantic vortex of accordance cubic feet of air. This, Proferrick in believes, would start a mang much of warm, mant air, causing a sall storm to break over each cone, and is breaking up energy which night therwise accumulate into one great tructive hurricane.

Prof. Franklin suggests that the U. S. Westber Bureau make a test with small ones in the tornado region of the

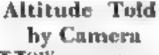
Middle West before extensive experiments, costing several million dollars, are conducted in Florida. Scientists who are akeptical of the plan point out that past efforts to create using currents of air by firing heavy cannon into the sky have proved imsuccessful.

Reverse Pliers Serve As Handy Valve Lifters

A little room in an automobile in change's lett, but solves the difficulty in houling up the valve apring of a motor when cleaning around it or removing the valve, has been put on the market by a French inventor.

The nevice consests of a pair of reverse phers with a series of teeth on the opportunate. The flat jaws of the part of the pash rod bearing. Compared the pash rod bearing. Compared the part of the spring. At the same time a wire loop ship.

over the teeth of the had paws apart. A spring connecting the lower handle and the wire loop pulls the latter toward the teeth when the handles are compressed as shown in the photo at the right.



HOW camerat may needs close contests for the worlds

arpane all inderecord was demonstrated recordly over Dayton, Ohio. Two Army armen took off from McCook Field and sourced to a height behaved to have been 40,800 feet. At their highest point, one of the men supped a picture of the city of Dayton far below. The weather was clear except for a scattering of clouds at six thousand feet, and the photograph, which was taken with a special high altitude samera, showed the various high ways and main structural features of the city below clearly.

Experts say that such photographs which show three or more distinguishable points on the ground, could be used to determine the altitude of the plane. The distances between these points are known from accurate survey data. By measuring the image reportations on the negative and knowing the distance from the negative to the optical center of the camera lens, the length of the perpendicular from the length of the perpendicular from the length of one percent mathematical accuracy by solving a geometric problem.

"Thrillers" Soothe Nerves, Experiments Reveal

IF YOU are nervous, read a number story before going to bed

The value of this paradoxical advice seems to have been shown by a series of tests conducted recently in the University of Chicago psychological laboratories. By means of charts of pulse and respiration, and similar scientific data, it was shown that after reading a "thriller" for an hour or more, the average person tested had a queter pulse, slower respiration, and greater self-control than before he began reading.

Ray M. Shipman, a graduate student in charge of the experiments, became interested in the calming effect of mystery stories a number of years ago when as a disabled soldier he was in a hospital for a year with nothing to do but read.



ALTONIO

BH E baggage

ar recently added

Committee to be

to ig between San

Here the pilots hold up valve spring. The jave are held open by a circ loop and spring.

Monte Calif enables passengers to thesk their machines during the trap and to drive away in them at the journey's

Invents Anti-Glare "Specs" for Night Drivers

DRIVER'S apertudes designed with the upper halves of the glasses colored green are the latest idea for protecting the eyen from the glare of approaching headlights at night. When you meet danding headlights, nimply drop your head slightly and look through the green, explains the sixty-year-old California uniterest who invented the speci

The lower halves of the glasses are slightly anothed to soften sunlight in summer driving. The goggles also are intended for golfing and beach use, the green portion serving as a significant.



The upper halves of the glamms are colored, green to shield the eyes against headlight plant.

end. When the destaution as ceached the baggage car are at the relation in the last inches shed rinway is at a paner as a party mobile is steered to the atreet, where the owner and passengers enter. After the porter close away the luggage, the machine is driven off home or to a butel

The new arrangement may be applied to other rai roads, permatting vacationists to take their automobiles with them to distant vacation spots without having to endure the struct of the long drive.

May Save Lives of Carbon Monoxide Victims

If A new resuscritation method, recently tried in animal experiments in the laboratory of Dr. Ladwig Schmidt-Kehl, of the I inversity of Würzburg. Germany, proves as successful in the case of human beings as it has in that of eats, there will be fewer victims of carbon monoride asphytiation in closed garages in the future. Attempts at committing succide by inhaling illuminating gas also may be thwarted by the new method.

Or, Schmidt Kehl claums to have revived cats, almost dead from carbon monoxide amphymation, by placing them in a closed chamber of pure oxygen under pressure which was alternately decreased and increased in time with the animal's own natural breathing rate,

The accentant explains that carbon monoxide possoning is caused by the abnormal appetite of the red blood corpuscies for the unwholesome ma. They take it up 250 times as readily as they do oxygen, and are destroyed as a result.

In this connection, Dr. Schmidt-Kehl points out that the blood flind, which ordinarily carries very little oxygen, may be induced to load up with an emergency ration by placing the asphymated animal (or person if the method can be a sproved upon to include human beings) in a closed chamber of oxygen under pressure.

Huge Tree from Tiny Seed

A TINY seed only a quarter of an inch long produces the giant sequois tree of California, whose average height is 275 feet and which may weigh 6,000 tons.

Stainless Steel Propellers Save Repairs





Carer op if a sav av e princher, , a ig at gazelo of corrector. Left Ferryboot drives by new propellers.

A KITCHEN paring knife has resulted as saving a San Francisco ferrybout company \$12,800 a year! It suggested the feasibility of making boat propellers from stainless steel.

An engineer of the company noticed that a stainless steel knife in his latchen even after years of constant use, did not become corroded by acids or by water. He recalled that at least once each six months the ferryboats had to be hauled from the water to repair the two propeliers, one at each end of the erait. The hubs and blades soon became pitted through corrosson. The cost of banking out the boats and removing and repairing and replacing the propellers was approximately \$800 for each propeller.

An experimental propeller of stainless steel was put through a series of tests At one end of one of the craft was fitted an ordinary cast-steel propeller, and at the other, the new standow steel propeller. Operating engineers on the ferryboot, which made twenty-min to trips between San Francisco and Oakland. reported that within two months after installation they could notice the difference in time between a trip when the new wheel was propelling the heat, and one when the cast-steel propeller was used. Figures kept by them engineers showed a reduction of six percent in operating custs, greater case and efficiency of operation, and higher speed when the new propeller was driving the bost.

When the experimental screw was examined after months of service it showed no corrosion or barnacles.

The steel that goes into the new propellers has a tensile strength of 75,000 pounds. They cost \$3,000 apiece.

The Birds Set Records in Trans-Atlantic Flight

THE first trans tilentic flyers were the birds. A British ornitaologist, T. A. Coward, has made a collection of the records of their fests of over-sea flying, which above the remarkable stamina of the feathered voyagers and their uncanny ability at unversion.

A tern, banded in Manne, was found at the month of the Niger River in Africa. A lapwing, banded in Ireland, was mught in Newfoundland the following year. Three luttiwakes, found living in Newfoundland, had been marked on an uland off the Northumberland coast of England. These bards, of the gull species, could rest on over-water flights, it is said, as they

are strong avanimers and sea-sleepers.

A relative of theirs, a black besided guil, that had been banded in Priusia, was seen on the castern coast of Mesico. Two American species of cuckuo sometimes reach the British Islas.

Odd "Duck" Suit Permits Walking in Water

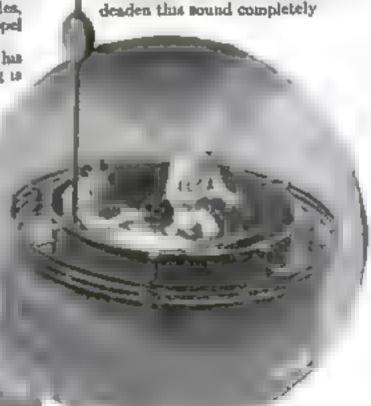
A MAN can walk through deep water a strong sout recently tried out with success by firemen in Germany. A life preserver-like buoy about the want keeps the wearer aftent and weighted aboes keep him in an opinght position. Small paddles, operated with both hands, help propel him forward at a fair rate of speed

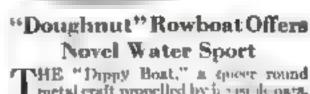
Queer metal wangs attached to has feet and anales open when the leg is pushed back and close when it is brought forward, mustar to the action of a duck s webbed foot. This drives lum ahead and up, adding to his progress through the water

The nut steelf is made entirely of moter and can be also be also be also be also be also be the control of the control of the control of the time spent in the water.

Radio Piano Invented to Hush Twanging Sound

A "RADIO PIANO," designed to eliminate the tweng of vibrating wires in radio reception by transmitting only the pure tone when the keys are struck before the broadcasting microphone, has been designed by an inventor in Toulouse, France. He explains that ordinarily the sound of vibrating wires in the instrument is fost to the ear when a piano is played, but that the delicate broadcasting apparatus catches and magnifica such sounds, marring the effect of the music. His invention is said to





metal craft propelled by it was decorate, was tried out recently by its ascentor, Julius Goldman, in Los Angeles, Calif A large circular pontoon, filled with mr, supports as many as eight people

The craft is propelled forward or backward, and also steered by means of the handles being operated by the passengers in the photograph. These handles are connected with oars which move under the body of the tanklike pleasure craft. A bumper extends around the outside of the boat. This allows two or more "Dippy Boats" to collide and give the passengers a thrill without doing any bacm.



Rendy for a stroll through the water. The strange outlit includes hand paddles, firm for the feet, and his preserver around the water.

Life's Riddle Is Nearly Solved, Says Chemist

DISCOVERY of the secret of hirthe crowning achievement of science -seems just around the corner, Prof. F G. Donnan, London chemus, recently told the British Association for the Advancement of Science.

Describing the work of Dr. A. V. Hill, noted British biologist, he announced that thus expert is on the verge of de-covering, if he has not already found, a percepte "of astounding importance to science a series of facts that may enoble science douby to understand the oil ference between life and death, and hence the very meaning of life itself,

Dr. Hill's extraordinary experiments, Prof. Donnan says, have already shown that a living cell, much as a cell of the human body, must keep in a state of constant art vity or it will break up and die. And this activity, which is a sense of fairly well understood chemical reactions, is mair instead solely by a continual supply of oxygen from the blood. In other words, the difference between a dead cell and a cell with the vital "apark" of life seems to be solely that the live one is a top-heavy, complex structure kept in equil-brain by nothing more mysterious than direct chemical action.



Speedy "Footmobile" Folds and Parks in Closet

WHEN you reach home in this run-about, you can fold it up, take it into the house with you, and park it for the night in a closet! It is a folding "footmobile" recently introduced in England, where wide use of it is predicted.

The foot-peopelling mechanism has three gears, and the bicycle wheels, running with a minimum of friction, are said to carry the light car at speeds of twenty and thirty miles an hour, without great effort by the driver.

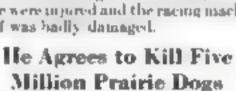
Just as in larger machines, the little vehicle is entered through a door at the side. It is equipped with a windshield and side screens, beadlights, and even a rearview marror. Both hand and foot brakes are provided to permit sudden stops in heavy traffic. Ingenious hinges at the center permit the vehicle to be folded to half its normal width for easy storage.

Camera Clicks as Racing Car Climbs Fence

RUNNING wild at more than a mile-aminute clip! Out of the driver's control, with its steering gear useless, this racing car plunged toward the iron feace that horders the track at Mancola, N. Y. Spectators scuttled for their lives as it slammed into the barrier and reared its nose skyward only an intrepid photographer remaining to susp this remarkable picture

Miraculously the driver of this car, William Darrugh, e-caped with minor scratches. A number of the spectators

who were standing on the datade of the fence were injured and the racing machine itself was hadly damaged.



ONE of the strangest contracts on record was made recently in South Dakota, when A. R. Plummer, of Belle Fourehe, signed up to kill 5,000,000 prairie dogs in two years. He contracted to eradicate a pourie dog "towa" which is so extensive that it occupies parts of two countries. Its inhabitants are estimated to number at least 5,000,000.

Their rapid increase has practically destroyed the usefulness of the land for agricultural purposes, while their harrawings have reduced its grazing value one ball. Thousands of acres will be restored to usefulness if Plummer wipes out the pests.



How the ingenious foot power machine folds up for parking in the house. The upper partiest shows the car spinning along the rund.



Sampled just as the speeding marking plunged into the fence.

Champion Linguist Knows Two Hundred Tongues

THE world's record for profesency in foreign languages is said to be held by foreign languages is said to be held by a ret red mathematurs professor in Frankfort-on-the-Main, Germany. He knows 200 toogues. He claims to be able to read and write all of these languages, ranging from Sanskert through Egyptian bieroglyphics and Chinese picture writings to modern tongues, and he is constantly adding to his list,

Last year, although he is an old man, he tackded four new languages. In the little bours where he lives, he has 15,000 volumes, collected from all over the world and representing dialocts and characters that would pusite a trained phisologist. Men from the Orient and other distant places have journeyed to this modest house to consult him.

He believes that Phoenician is the most important of all the 200 languages he knows. For relaxation after his studies he writes poetry, saying the music of rhyming words soother the mind.

Record Overland Vision Nearly 200 Miles

HOW far can the human eye see over the surface of the earth?

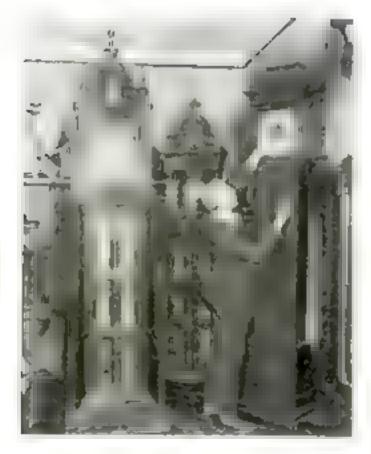
Engineers on the French Mediterranean coast are reported to have sighted lights atop the mountains of Cornes, a distance of 108 miles from the court of France.

In the United States, twelve-inch mirrors on Mount Shasta, in California, were recently seen from Mount Helens, one hundred and mnety-two miles away

Plane Terrifies Pygmics

SO TERRIFIED were New Guinea, by the apparation of an American airplane out of the sky that it took members of an aerial expedition exploring the country hours to convince them that no harm would come to them.

"They boited for cover in all directions when we dropped from the clouds in our airplane," Dr. W. W. Brandes, of the C. S. Department of Agriculture, who headed the party, reported when it recently returned to civilization. It had covered 11,000 miles of wild country.



Keeps Hundreds of Antique Clocks Ticking on Time

A TIQUE clocks may be ancient but those in the cubection at New York University, New York, City, must not run beliefed the time. So Professor D. W. Hering, in charge of the James Arthur collection, has a job on his hands. He is here pictured making the rounds of the hisidays of ancient time-recorders to regulate there.

The clocks are so remerors that when a charge is made from standard time to daylight mixing time. Prof. Horing must begin setting the clocks two days before the date set for the change. The collection has been in the process of accumulation for nearly half a century. It is the largest of its kind to America and, including watches, contains about two thousand ancient timepieces.

Some of the old grandfather clocks date back to the early sixteen-hundreds, and were among the first of the kind constructed.

Upside-Down Skyscrapers Proposed in Japan

An "TPSIDE-DOWN skyserapor" descending eighty stories into
the earth is suggested in Tokyo, Japan
The building would be sunk 1 100 feet
deep. The design calls for a hage eigenbar
wed braced with steel framework. The
offices would be lighted continually with
electric lights, and ventilating shafts
would provide the necessary fresh ar
Telephones would connect the offices with
the buildings of the city above and high
speed elevators would carry the workers
down to their places of business.

Since the disastrons earthquake in 1923, attention in Tokyo has been turned to seeking earthquake-proof designs of architecture. The project of a downstairs skyscraper was made with this end in view. The cost of such a building is estimated at \$11,000,000.

A somewhat similar suggestion for solving traffic congestion by building deeper into the earth has been made in Pazis. A network of deep tunnels to carry freight, cars, and pedestrana is proposed.

Lighted House Numbers, Law in Stockholm

Hot SE numbers that can be seen in the dark are required on all homes in Stockholm, Sweden, by a recent musicipal ruling. In the winter, darkness falls early, sometimes by two o'clock in the afternoon, and the difficulty of finding addresses in unfamiliar districts aroused the city officials to action

All house numbers must be placed a certain height above the street and must be illuminated. The approve I type of lighting consists of an electric lamp under the number on an arm that extends out over the street.

Plane's Wreekage Tells of Amundsen's Fate

A BATTERED wing-tip float, pulled from the jey waters of the Arctic Ocean by some Norwegian fishermen recently, gave the first concrete evidence of the fate which befell Roald Amundsen and his four French companions who took off in search of the Holio survivors last June.

The large Latham scaplane which

flew from France to Norway where it picked up the veteran Amundsen and proceeded to Spatzbergen, disappeared on its flight in search of General Nobile and his companions of the North Pole arrship.

The float was shapped back to Paris, where it was identified as one belonging to the Latham machine.

Electricity Fights Pests; Electrocutes Rats

ELECTRICITY is fighting man's battle against insects and redents in an increasing number of ways. In Switzerland, it has been used to save a field of tematees from grabs which formerly runed fifty percent of the crop. Brilliant electric lights, with reflectors directed toward the soil, were placed at intervals in the field. They attracted the moths which lay eggs from which the grubs appear. Bastos placed below the lamps and filled with water and gazoline caught and drowned thousands of them. As a result, fields in which the experiment was tried had an almost perfect crop, while those near by lost from thirty to sixty percent of the tomatoes. The same method has been tried with equal success in melon

A new device for getting rid of rate, proposed by a Rhode Island Inventor, electrocutes the rodents. A metallic disk

in the center of the apparatus holds a piece of cheese, Thus disk is surrounded by live wire" in the form of a metal ring charged with To get the electrosty. cheese, the rat must place his land feet on the ring and he forepass on the metal disk thus completing the circuit. The eventor advises that the apparatus be passed ever a barrel of water. Thus, in case the rat is stumped but not killed by the electricity it who full into the water and drown; also, the rat a body need not be removed to make way for the next victim.



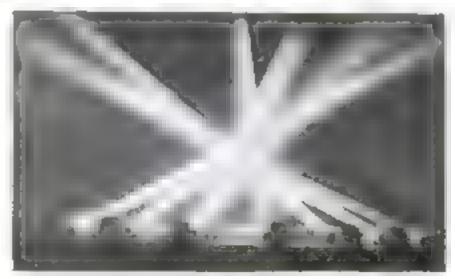
Wrecked wing float of the lost Assundant plane, pulled from the Arctic Green in the arts of Norwegian Schermen.

Searchlight Battery a War Game Spectacle

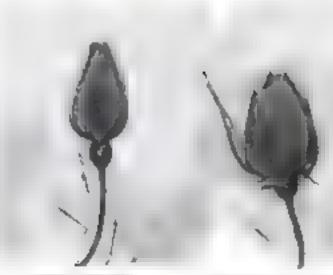
La retroised in the darkness at the recent Army Ordnance demonstration of new war material held at Washington, D. C., as they combed the sky for night-

flying ascens as part of imaginary buttle operations

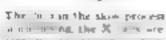
k battery of the latest huge searchlights, developed by the Army for detectthis enemy fivers at right, formed one of the main attractions of the show. It drew huge crowds to watch the powerful streams of light moving in weird formations across the sky. The demonstration was beld in the burrack grounds of the War College near the Potomac R vee. Such an exlattion of the latest developments on the war equipment of the Ordinace Department is planted by Army authorities as an annual event in the fature.



A bettery of bogs Army search@sta, sweeping the sky for sirphests, produced this magnificent display in demonstration of war equipment.



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Arthur C Pillsbury, the photographer who produced the remarkable X-ray mulips picture examining the firm. Note its great width. The motor which runs the camera is seen at left.

X-Ray Movies Reveal Blooming of a Rose

This serret of what takes place in the historial arcse on it unfolds from the bud, in revealed for the first time is an amazing moving picture film recently made by a Berkeley, Carf., photographer of botan calculates, Arthur C. Pillsbury. He employed an X-ray tube of low voit age, which casts the shadow of delicate objects upon the film, without destroying them. This tube was designed especially for the work by Dr. William D. Coolsige, inventor of the "Coolsige tube."

The camera itself is a lead-lined box with a ruby-glass opening, against which the subject is placed. In taking a succession of X-ray photographs to produce the motion picture, the film, which is unperforated, is grapped between collers

as by the new part of the second as by the techniques of the techn

The first picture made with the new apparatus was recorded on 200 feet of special film of unusual width. A small electric motor operates the camera automatically. Governed by clockwork, it turns the X-ray on and off, moves the film, and operates a brake which stops all movement at the proper time. Once started, the camera will run without attention for several days.

In making the film of the development of the unseen parts of the rose, the X-ray was turned on at five-minute intervals over a stretch of seventy-two bours. As it penetrated the petals, leaves, and stem, the

film recorded the changes that had taken place during each five-minute interval.

Tests are to be made of the ability of the apparatus to record other delicate, unseen operations, such as the knitting of bones fractured in the legs of rats, the development of an embryo in a pigeon's egg, and similar subjects. Eventually it may be employed to make motion picture records, for the first time, of the operating mechanism of the human body.

Rum Runner, Set Ablaze, Tests Fire Boat

A NEW use for rum-running vessels—
that of testing the efficiency of fire bonts—was demonstrated recently in the hast River at New York City—One of these captured outlaws, the Halegon, was set on fire in the river. As the blazing vessel drifted past one of the spans that bridge the water between Manhattan and Brooklyn, the crack fire boat of the New York Fire Department, the John Purroy Mitchel, its propellers charning the water

as it slowly moved into position, went into action. Powerful streams of water shot from several angles upon the flaming rum runner. Hundreds of people lining the rail of the bridge were interested spectators.

in a few minutes, the torrent of water had smiffed or t the blaze demonstrating the speed with which this modern type of "water fire-conder." which pairols the waters of New York Harbor, can extinguish marine blazes.



In the shadow of one of the Kast River bridges, New York's exact fire boot, the John Pueroy Mitchel, plays its powerful streams on the captured race runner Haloyees, purposely set also for the test,

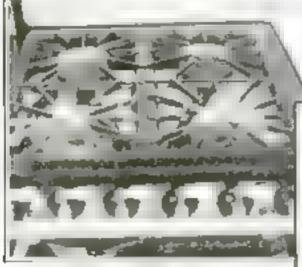


Airplane Pioneer Builds Novel Motorcycle

COMBINING the comforts of an automobile with the economy of a motorcycle is novel two-wheeled machine has appeared in England. It was designed by A. V. Roe, famous amplane builder and the first man to make a flight in a Brit shiplane on British soil, early in 1908.

The Ros car, the only one of its kind in the world, is equipped with a three-horsepower motorcycle motor which drives the rear wheel by means of a shaft. It is said to attain a speed of exty mines an hour, and, because of its narrow width, can squeeze through close places in traffic. The driver rests on a well-upholstered seat protected from the wind and dust by a shield. Behind the driver's seat, the flat body provides ample room for luggage.

The photograph above the air pioneer driving his latest invention, which is held erect when at rest by a metal stand.



Direct metal sings for gas at we burness mental state in the de tog the man twhere we they all ments of man and there are the state of th bie friebiges gentig gant ie de ar

Latest Inventions for the Household



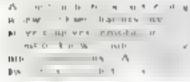
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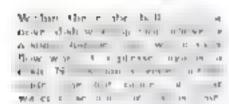


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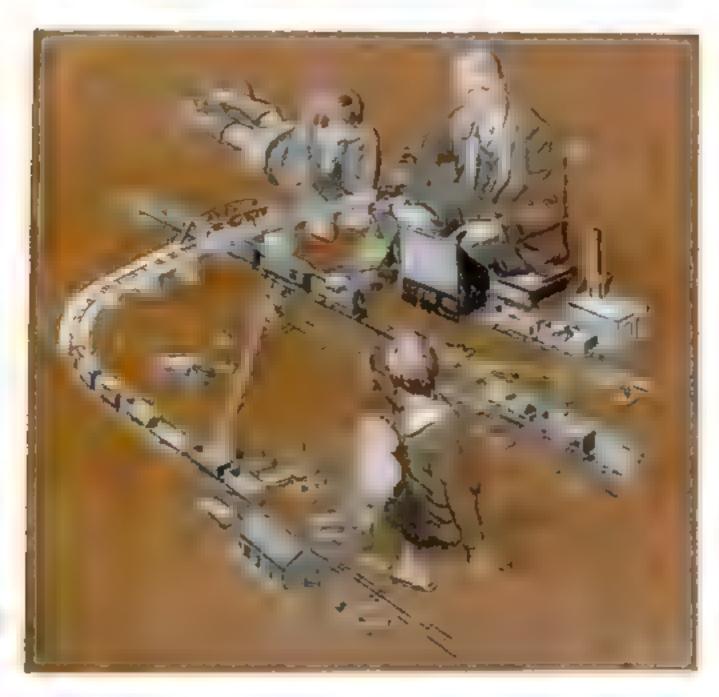
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Insert this new automatic support in a bottle and latent commences to flow Remove + and the flow strat. It fills bottles with from name or vinegar and batteries with distilled water. Drawing out a philipper in the bottom prepared the aphene for out.

You can't cut your hand with the bread know on this saw shi er it is said. A winder out at once is straighed by a hand of aping metal to a wooden gapth. When t is shi ed, the guard is greeped by a handle beneath that keeps hand out of darm a way.

Setting Up a Model Railway



You can get infinitely more fun from operating a model railroad if you arrange an interesting and comissing lawant of tracks.



How to Plan Your Layout to Make the Most of the Space—Laying Track—Curves and Grades—Portable Outfits—Muffling Noise

By FREDERICK D. RYDER, JR.

NTHE operation of a model railway, there comes a time when you tire of watching the train go round and round a plain circular or ovar track. And then, quite logically—you decide to expand it into a more comprehensive system. As a result you hav your self some more track, a few switches, and auch other accessories as happen to appeal to you. This process is repeated several times, Eventually, your model railway loses all semblance to a real railway loses all semblance to a real railway and becomes, instead, a conglumeration of weird curves and impossible adings that looks for all the world like a centipede in convisions.

Careful planning will save you money and result in a much more interesting and satisfactory model railway.

The first step in your planning should be to decide what, in your own mind, would constitute an ideal model railway based on what you know of real railroad practice. Then you take a pencil and paper and figure out bow near you can come to that ideal. Of course, a perfect model railway would be one that duplicated in minuature every piece of railing stock, every font of track, and all other apparatus found on a real railroad. Obviously that degree of perfection is an impossibility. The best you or anyone else can do is to decide on some delimite degree of accuracy in your model railway and strive to be as consistent as possible in maintaining it

The foundation of any radway, whether full use or ministure, is the track layout. Real radroads have stretches of track hundreds of miles long. And right here you strike your first compromise with accuracy. The space available precludes duplicating such a layout in ministure. You will have to use your imagination and consider that long stretches of track have been compressed lengthwise to a far greater extent than would be permissible in a true scale reduction.

Since your track will of necessity be foreshortened, it seems logical to have the locomotives and cars somewhat shorter than scale length, provided, of course,

that they are otherwise of the proper dimensions.

The same reasoning applies to the curves in the track. You cannot duplicate the long, easy curves of full size railroad right of way. Your curves must be much sharper in order to be practical in the space you have available.

The question of space governs the possible track layout. The larger the space the more elaborate the layout can be, but careful planning usually will result in a satisfactory and workable track layout even in a small space.

There are two general types of track arrangements in common use in model railway construction. One is called the "point-to-point system" and the other is the continuous run."

In the point-to-point system the track layout includes two terminals with one or more tracks connecting them. This are run from one terminal to the other just as in real railroad practice. This arrangement is most popular when clockwork locor stives are used or when the space is particularly suited; for instance, when the track must be laid in two small rooms with a long hallway connecting them.

The continuous run track tayout is far more popular. With a proper terminal (Fig. 3) it more nearly duplicates actual railroad practice because the train can be run around a sufficient number of times to simulate a long trip. You may, indeed, have one or two small way stations on the track and consider that the distance between them consists of ten or fifteen laps of the track instead of the few feet that actually reparates them. Of course, it requires a bit of imagination to make this seem real, but if you didn't have a good imagination you wouldn't be interested in model railways anyway!

One limitation on the size of your model rankay over which you usually have no control is the floor space that you may use for the purpose. Just so much space is available, and your problem is to work out the most practical track layout within the dimensions of the floor.

You don't, of course, have to lay the

track on the floor unless you want to. It often is desirable to erect a shelf or bench around the watts and lay the track on rt. Thu plan has much to recomisend it. Working on the ratiway and operating it on a wast-high shelf is counderably loss hard on the back muscles. Also, the track is not so likely to be damaged, and the space under the shelf can be used for storage. When the dimensions of the room are small, you may even erect. a wide shelf at want beight

and then a narrower shelf just above it with a grade connecting the two levels.

IT IS difficult to give any definite directions as to the actual track layout Typical point-to-point and continuous run fayouts are illustrated as Figs. 5 and 6. but a book could be filled with the possible track arrangements that could he worked out even in a small maps. However, there are certain general prisciples that should be kept in mind. First remember that nothing is to be gained by making the track layout needlessly complicated. Second, observe the common radroad practice of heeping awitches off the main line as far as possible. Don't force the train to run over a long succession of switches each time it makes a circuit of the track. Put a switch or two on the main line and let the other switches lead into the siding thus formed.

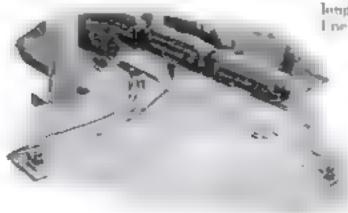


Fig. 6. Two standard right hand switches, one lefthand switch, and shortened sections of track were used to make this V hading from main line to terminal.

You can use a single main hise around the room; or, if there is space, put in double track with not over two crossovers arranged so that you can switch the train from one track to the other no matter which way it is going.

Place your terminal where you can get at it as easily as possible to do the necessary hand operations of making up trains and handling them in sidings. Unless the room is very large, be content with one terminal and one or two passing

stations located at whatever points on the main line seem most autable

A SINGLE swetch on the main line may the used to bring trains into the terminal, but a Y will permit you to start trains off in either direction and come back into the terminal by way of the other branch of the Y. It also will permit you to turn a train without taking it off the track



Figs. 2 and 3. A locomotive pulling a freight train up a grade of 1 in one is 30 in and a well arranged terminal.

The enution about switches on the main has does not apply to the terminal. You will find that, as your system grows, every siding you can find room for will prove useful for our storage and switching.

It also is desirable to have at least one long inding with a switch from the main include at each end so that you can hold a

train on the siding while a train traveling in the opposite direction passes or so that a slow freight can get out of the way of a fast passenger express.

To start the actual plan, take a large piece of paper and mark on it the outlines of the room, using a relatively large scale. One inch to the foot will do very nicely. This will give you a fifteen-inch square for a room measuring fifteen feet in both directions. Now, with the suggestions above mentioned in

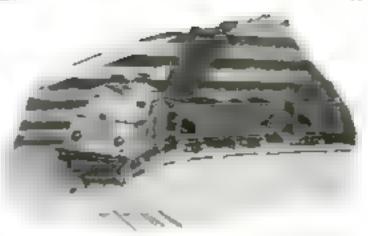


Fig. 1. To book a curve at the end of a long stretch of track, bits of wood are placed beneath the ties.

mind, lightly sketch a proposed track layout. Over this light outline, draw a plan using a scale reduction for the curves of the track. Locate all the switches and track you expect eventually to install even if you don't expect to build all of it right away. Then you can work to a definite plan. Furthermore, if the plan is accurately drawn you can calculate from it how many sections of teach you will need to complete each addition.

It is one thing to draw the track on paper and nometimes a much harder problem to make the standard curved in thought track sections fit together the remain track into the terminal probably will give you some trouble. Of course, you can make a Y out of standard track sections if you make it log chough, but to get a compact Y you

will need to cut some special

lengths of track.

The sumplest way to lay the

I in to connect the curved end of a right hand switch to the straight end of another right-hand switch by means of one curved section. Then take two straight sections and a relibend switch and cut off enough of one of the straight sections so that you can be up the curve of the left hand switch, Complete the job by cutting straight sections to jost. A Y assembled as described as how a to Fig. 4.

There are two ways to cut track to any deared short length. One is to saw it

at the descred point with a hackest fitted with a very fine-toothed blade. A 32-tooth-to-the-meh blade will do. This method is not as easy as it looks, however, because the thin sheet steel catches in the blade. Another method is to cut the track with a pair of the simps and then reshape the track ends—they will have been flattened out of shape—by the careful use of a pair of round-nosed pieces.

YOU will find many places in any comprehensive track layout where cutting off a standard section will permit an arrangement that otherwise would be impossible.

The smooth operation of the locomotives and cars over the track and switches cannot be expected unless care is taken in laying every section. Be sure that every pin fits tightly. One loose pin may hinder the flow of electric current to the locomotive over a considerable section of the track and (Continued on page 117)

When and How to Apply Kalsomine

Methods, Materials, and Tools for Decorating New and Old Walls and Ceilings

By F. N. VANDERWALKER

ALSOMINE may be the most su table finish for the walls and ceilings of your home, or perhaps for the ceilings alone

"But how can I decide that?" you ask Well, take the case of a new house l'anally the owner wants to occupy it at the earliest possible time. Plain white puster walls are not very my ting, yet it a generally known that to point new photer immediately is risky because of so-called "hot spots," which are apt to fade oil colors and horn the life out of the od or varmali hinder, causing dead, flat koking biotelies. Furthermore new plaster is expected to settle and probably crack in places during the first winter For these reasons it is desirable to desorate the walls and century in the least expensive manner and kulsomine

Kalanmine is to be recommended, too, when a frequent change of color is wanted, and also when it is describe to get the decoration done in the quickest

possible time. Kalsoarine gives artistic, pain absolitely flat or pastel coloring and ments consideration for that reason, ande from its inexpensive character.

ON THE other side of the account we should consider the Louitations, While good kalsomine today does not ruly off I ke whitewash and as and somme did years ago, it is not washable. It is applied in one coat over a mre coat on either new or old walls. While you save in the first page by decorating with kalsomine, a part of what you save will have to be paid when redecorating at a later date, for the old finish must be washed off before redecorating with kalsonine, with paint, with wall paper or wail fabrics, or with lacquer.

There was a time when professional dec-

orators mixed up there own kalsomme from whiting, glue, dry colors, and water but little of that kind of kalsomine is used today by anyone. The bulk of the kalsomine is made in factories. After the addition of water, the dry prepared kalsomine is ready for the brush,

Prepared kalsomine can be had at any point store in small and large packages and in one or two dozen delicate tints and shades. In a majority of cases the desired color can be selected from the color card, all you have to do is to add the water and mix up the material. When some unusual tint is needed, buy one of the available tints that is very near to what you want and then add to it a little of one of the other colors

add to it a little of one of the other colors on the color card to give the exact toil desired. New plaster of the smooth type to be

kalsonmed calls for little preparation

aside from sixing and chipping off any splashes of plaster. It is best to cut off such splashes or fire with a putty knife rather though fine annipaper, although fine annipaper can be used. The truweling of the poster produces a hard glaster shell on the surface and it to better not to cut through sat if it can be avoided.

sand finish plaster, if new, sally requires to be swept with a broom to re-

Old walls having kalenmine must be well washed I se two pails of warm water and a good sponge Some painters first take a kalsomine brush and wet three or four square yards of the old kulsomine with water. Then the sponge is soulerd and used to wape off the kalsomine. When the sponge u loaded with kalsomine. muse it out in one pail and wipe the wall again until the surface as clean. The final wipang should be with the clean water in the other pad, after the sponge



Knissenium is flowed on freely with a broad brush made especially for this purpose. Only one cost is necessary.

has been consed out as well as possible. If old kalsommed walls have had a varnush or gloss oil age on them, that mat will not be removed by the washing and it will not be peremary to use again before applying the new kalsomme. Gloss oil are serves well enough for kalsomine. but it is decidedly out of favor, because later on it may be desirable to use paint, wall paper, or wall fabric and none of these decorations adhere well to this kind of size. Wall paper and fabrics will not stick unless a special treatment committing of a coat of flat paint and a size of sugar or molasses and glue is first applied. If the use under the old kalsonum was a glue size, it will be largely removed with the kalaomine, and the wall alroyld be speed

KALSOMINE on a sand-firms wall cannot be removed completely, but the new size coat binds in place what kalsomine is left in the low pores of the plaster. A stiff brush aids in washing off the kalsomine from a rough surface.

When papered walls are to be refinished in kalsomine, it is best for saintary as well as practical reasons to remove the old wall paper by soaking it off with water and accaping with broad scraping knives. Occasionally ingrain and plain wall papers are used and kalsomined, but the job is not generally satisfactory for a very long time.

Kalsomine can be applied over painted walls. If the paint is dead flat, simply sum it like new fontened in page 111)



Dutch halacteine breah, scroper putty knife, wood paddla, and pointing trowel.



be wished off be-

fore new is applicable

You Can Make Artistic Hinges

And Other Hardware by Following the Simple Methods Described in This Article by EDWARD THATCHER, Noted Craftsman and Teacher of Decorative Metal Work

O BE durable and look well, home made hinges, bandles, and key plates should be made of remon-noly thick metal—the larger the

piece, the thicker the metal. From Nos. 14 to 18 standard B. & S. gage sheet metal abould be used for most of this work, but small hinges may be made of No. 16 gage. The metal may be copper, brass, bronze, or even mild (machino) steel, although the beginner will do well to use copper, which is strong yet softer and more ductile than the other metals.

A cold chisel is used to cut out the designs. This is one of the oldest methods, but it is none the less very effective and is usually the hest way of cutting the thicker metals in the home abop.

The design is drawn full over and transferred to a sheet of cardboned, which is then cut out to form a template or pattern. Avoid, at least at first, designs with many intreate curves and angles. Simpler designs

When the design is ready to be out the metal is usually placed on a noft cast from block. Wood or lead toocks are not stort enough for the work, though they may be used to support thin metal. Sometimes you may find a block of cast from at the junk yard. For small work the bottom of an old flatiron will do. Never use the face of your anyll for that work. The writer uses a square weight from an old domb-water, which weighs eighty-five pounds.

The cold chisels used for this work may be of the actionary variety, but the edges should be ground slightly rounding across the chise, as shown in Fig. 1 page 118. The reason for this is that the corners which are apt to break off do not reserve the full force of the bijow, an edge of this

Inc. Red Parks and Parks a

Little equipment is required to make most attractive brages, drawer pulls, key plates, and other hardware for furniture.

kind also makes it much easier to follow a curve by filting the chard as you cut

It is bands to have several clinicis of different widths \$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2} \text{ and } \frac{1}{2} \text{sn different widths \$\frac{1}{2}, \frac{1}{2}, \frac{1}{2} \text{ and } \frac{1}{2} \text{sn different widths \$\frac{1}{2}\$ ones may be made by granting down common bad sets. Professional metal workers use a chiscl with an edge shaped like that shown in Fig. 2 for some curved cuts.

BEFORE you start work see that your sheet meta is perfectly flat. Place it on an arred and flatten it with a wonden maket if necessary. The icon block on which you do the cutting should be placed on some solid leves surface. Set your work isn it and start cutting with the cold chisel of course using a hammer to drive it as shown in one of the pandos below.

Do not try to cut through any one part at once, but go over the line lightly at first, and then go over it a second time, sing heavy harmer blows. You may

have to go over the line three times before you cut through the metal. As you cut through, break away such parts as are to be returned.

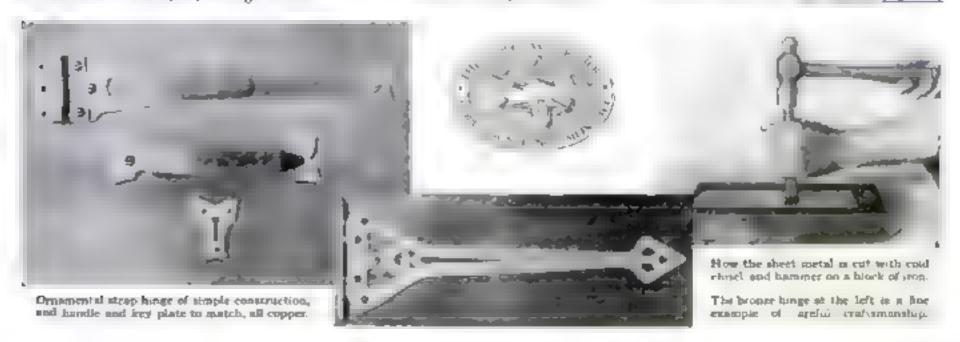
When parts of the metal are to be cut away inside the main outlins of the work, it will have much time if you will drill a fairly large hole in each angle or corner of each space. Cut up to these holes with the chiscle and when the outline has been practically cut through, place this part of the work over a hole in an arvil and use a flat ended punch to break out the worts.

Always leave enough metal about the cut edges to allow you to file down to the line after the cutting a finished. Work made of sheet metal will hook much thicker warn

fineshed of ad the edges are seed charactered or rounded over, so the eye sees morn of the edge

The writer most emphatically does not believe it necessary to cover coch and every piece of work with hammer marks. It is quite easy to overdo the hammer marking it plans sheet metal surface if left on an attractively designed and executed piece of work, is often more desirable than one battered up with openingless marks.

There are of course, I mes when hammer marks certainly do and something to the appearance, then they are made with the rather flat rounded end of a planishing hammer and are of different winths and depths with some overlapping and perhaps with an inhammered surface here and there as find men on page (19)



How to Build a Real Fireplace

The Trick of Making an Open Hearth Supply Cheery Warmth without Smoke Is No More of a Mystery than in Olden Days

By BASIL EWING WEBB

YOU'VE often heard it said that fireplace construction that fireplace construction is a "lost art." In this article Mr. Webb reveals that it is more of an exact science than ever before. And he gives simple rules and measurements that will turn your dream of a cosy fireside into more than puffs of grissy soot.

Is thus the moving Yes, ma'aro. "Well, I am Mrs. Whyte

I want to be moved tomorrow. Please be very careful in handling

the parrot, the goldfish, and the open fireplace—' "The what, ma'am ""

"Open fleeplace! It belongs to us, so of course we take it along when we move. It looks like brock but it a made of tin or suggething to it is easy to lift, but it can get dented. A grate full of red but coal goes with it. You understand the coal is really not red-hot because it is not coal but only seems to be, which is very cheering on a cold winter eve-Ret gla

"All right, ma am: We ll try not to barn our hands

The gody-muded nigh over each a tale, hat the old liner growns despondently and says the Ameriean hearth has become is recall the geniane fireplace of our sires, noble and massive, wherein a sheep or quarter of beef could be roasted, that heated the whole bouse and was the proper center of the home.

But let the old-timer cheer up. Make-believe masonry and imitation fuel have not yet routed the real artists by a long shot, even though the fireplace has indeed last much of its ancient utilitarian value in conlang and general heating

TRUE, tests have shown that an open grate burns seven to ten times as much coal as a steam boiler to produce equal temperature in a room. Most of the fireplace heat flies up the channey. But it is unfair to condemn the fireplace because it cannot wrestle against zero

weather. It shipes on cool days in string and fall when the furnace is not going.

It removes the chill mornings and evenings. It toosts the shins while it gladdens the eye. It emits sulutary heat rays which no radiator or register supplies. Thus we derive health as well as comfort from the crackling logs or glowing coul

When fireplaces smoke it is usually because they are not built in the right way. But cometance the fault is in the channey or in improper stoking. If you pile up a large mass of green wood and try to hurn all of it at once, no flue will carry off the volume of smoke produced. It is a good rule to keep the fire in the center. Put a log on the audicom at the back,

burn it in two. place the pieces logether, and set another log above If the logs are small they burn well in pairs on the andirons but this spreads

fare and tends to smoothess If a good suced fireplace throws out only a little heat, this is because the back and sides are straight, so that the beat shouls up the chimney instead of being reflected into the room. Few masons today know much about fireplaces. One might think there was a mystery and a

AMORE CHAMBER WITH IN DEA R TON, LET FOR 10 IN BISS

SHOULD SHELD HOT LE THAN 4 IN WIDE

с манне на дережна Взили не повр стемна

lost art involved. Perhaps the mystery is that intelligent owners do not take a few measurements to see whether the sample rules of right construction are followed

FEW ample rules enable anybody to Acheek up right construction If the width of opening in thirty two inches the height should be twenty-eight inches and the depth asventeen to twenty-one inches. If the opening is three feet wide, a couple of mehes may be added to height. while the depth remains twenty-one inches. A width of four feet requires height of thirty-two spekes with a depth between twenty-one and twenty five inches. The inner sides of the fireplace

should be slightly beyeled to reflect heat into the room, and for the same reason the rear wall should slant forward, starting about a foot above the hearth level. We do not have to figure the amount of patch when we use, as in preferable, a ready-made cast-from throat with damper. Let the alope meet the bottom of the throat, and by using a wooden form set at this angle anyone can lay the bricks to make a smooth unform slant. The rear slope is more important than the side bevel and should never be omitted

The trun throat combination is made to support the top of the

FLUT LIN NO

AFEA 'IS OF

SAN K LOW BYCK COMMON

THROAT 4

WHEE

ASP DURCH

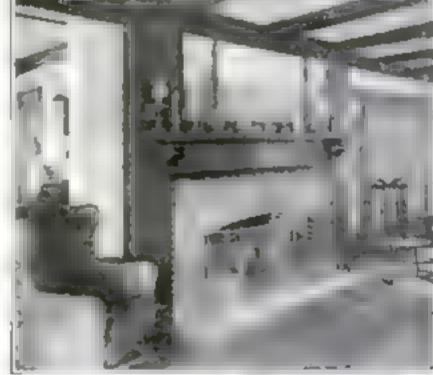
PACEDRICH

FIRE BRICK FOR

fireplace opening This obviates the oldtime metal bar or arch construction The Iron thront should extend the full with of the fireplace opening, and its own width should be four to five tuches. A damper of the chain, werm gear, or lever allows type variation in the smoke oullet, according to need, with total closure to map mer to keep in-

sects from entering. The damper is also useful in winter when the fireplace is not in action to keep cold air from descending the channey and refrigerating the room

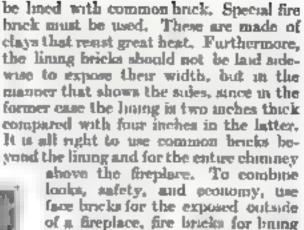
Chief essentials of an effective fireplace are a smoke shelf and chamber. The shelf is a flat stretch of masonry



The one fault of this freplace is she from a present. It should niver the entire opening curving muzzed at the top, to keep specks from figure into the room or up to the wooden mentel. In the diagram at the night are revealed the most important points to be observed in the currest construction of a fireplace

furnace or stove being permitted, It is often possible to correct an old

fireplace that is faulty. The dimensions of the opening can be reduced. If the height is too great, ruise the hearth with a layer of five brock in mortar or with concrete remorreed with wire mesh. The same end may be accomplished by lowering the top, having an angle iron across to support a line of new bricks. It as



of a fireplace, fire bricks for bring the maide, and the common variety

of brick for the rest.

N RESPECT to thickness the ande wells usually take care of themselves. One of them contains the furnace flue with a casing of one width of brick, which totals not less than sixteen inches of thickness. in front, with an increase toward the back due to bevel. The other side wall matches for the take of

symmetry; it is often built bollow.

but might well be

filled with brickbuts and mortue. The back wall has surposa theksess at the alant, for the appear between st and the vertical exterior aurahould he filled with solid massenry. The date ger point is along the foot-high vertical part of the wall below the blant, which usuoily is two hincks, or eight inches, thick A longcont over wood

fire will make the

A well-constructed fireplace for a small home. Note the interior built of fire brick made of special clays that resist trumendous heat. outer brick on this vertical too bot for the hand, which is a token of hazard. If fluoring or a beam beneath touches thus superheated masonry there is a slow charring of wood that prepares the way for a conflagration. The oninous process may go on for months and years with the final act of ignition due to crumbling

> mortar joints, or oily rags, paper, or rubbish in contact with the brickwork, An extra threkness of a foot or so makes

the vertical back wall that much safer. However, the fire underwriters approve the lesser thickness provided that no woodwork, whether flooring or beams, comes within two nelses of the aides and each.

Thus two-meh space is to be filled with loose meembustible muterial, such as asheslos or mortar. rubbish, supported on a metas step united to beams. A similar insulating space is required around the chimbey at the second floor and at the roof. The ord-time practice of framing beams into a claimey is strictly prohibited. It involves both fire (Continued on page 159).



The droplacy in an old-time farmhouse is Massachusetts. Its large one was never eary to supply not only heat for cooking and comfort, but best to supplement readirs.

throat top, of the same length and not less than four mehes wide. It serves to haffle the back-deaft of amoke that normally slides down the rear wall of a chomney and throws it into the strong up-current of gases. The back-draft is rather weak and can be thus diverted by a shelf at right angles to its course. But if the shelf is moving or is imptakenly aloped downward, the backdruft keeps arricag and some of it entent the room, with amoky consequences. The

A massive stone freplace. Since

utone is less are resistant than

brack the walls about he tweet so thick, or at least dates inches-

built along the back of the

smoke charrier is a space naturally formed by the gradually narrowing walls to connect throat and shelf with the fine. It is larger at the bottom than the topand acts as a reservoir to hold surplus smoke for a moment when gusts of word tend to seas the channey nutlet, also when green fuel suddenly belches a large volume of smoke. The recommended pitch of the chamber is one foot for eighteen inches of rise.

SMOKE chambers can be obtained ready made, and they are worth getting, both to samplify the job and to insure first-class results. The ordinary practice is for the misson to sarrow the walls with Jayers of bricks in steps, which makes a mugh, jagged interior with much friction and tuemoil for ascending smoke. Smooth walls are almost as desurable for conveyance of games as for water; they increase espacity and reduce back pressure. So it is an advantage to have a ready-made chamber, of metal or rereforced concrete.

The chimney flue should be one tenth the area of the fireplace opening. For example, the area of twenty-eight-bythirty-two-meh opening is 896 square Inches, of which one tenth is eighty-nine. We select a fine hoing eight by twelve inches, since this is the nearest size available. While the most efficient flor shape is round, or elliptical, it is difficult to obtain such shapes and the ordinary square or oblong types are easier to in-stall. Be sure that fire clay flue fining, not drain tile, is used and that it extends the whole distance to the chimney top. Space between fining and brickwork should be packed tight with mortar Each length of Lung should be well fitted to the one beneath. The flue should serve the fireplace only, no other intake from

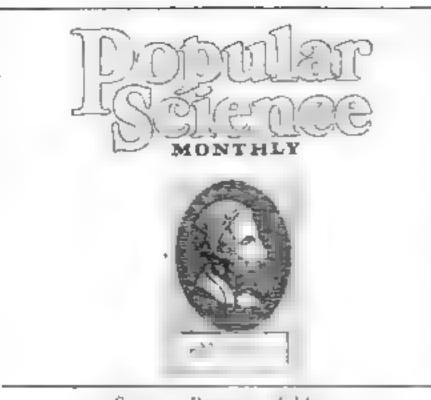
ample to reduce winth or obtain beyeled aides with bricks and mortur. Bricks can be cut to angles with trowel or cold chisel. There in more of a job in goving the rear wall a forward slope that will stay put. Con-

crete reinforced with beavy wire mesh attached with expansion bolts to the old wall may serve, but it is better to use bricks with frequent anchorage of expansion holts. And before starting work on an old fireplace, the interior abould be thoroughly eleaned with a wire brush and acrubbed with washing gods. A moty surface filled with cremate does not invite mortar to take

The interior of a fireplace abound never



Though a fireplace in wasteful of fuel, burning mearly ten times as much so a furnece to produce the same temperature, yet the chancy blane of its logs adds constart and beauty to pull boom.



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The Driving Force That Wins

WO articles in this issue drive home the same point. One tells of Hago Eckeber, master mariner of the sky. The other begins a series about Wilhar and Orville Wright. Eckener was a mature man, with a reputation as an economist and a writer, when be interviewed Count Zeppehr and became interested in the possibilities of airships. The Wrights were small-town Ohio boys, who never completed their high school education but made the airplane possible.

At first glance, there seems to be slight resemblance between the careers of these men who have quade history in two phases of aviation—which with racho most the automobile promises to change the customs and habits of the world. When they began their work the run is resembles of both beckener and the Wrights were magination and enthisiasin. Neither had the benefit of specific truning for the work they set out to do. They succeeded, nevertheless, in highly technical fields.

Lack of traiting can be remedied, lack of imagination and enthinasm cannot. Imagination pushes the mind forward and enthiasam is the driving force. Progress in mence, and in everything else, must have these two qualities for its foundation.

New Ways to Make a Million

ROGER BABSON, business statistician, lists seventy opportunities to become a subionaire. Among others he mentions watches run by radio, self-finding golf balls, precast tunnels, volcame power stations, automobiles that can run sideways for pariting, and a method of changing birch into mahogany. Some day someone will seize every one of these opportunities.

Wonders of science are following each other so rapidly these days that we can even speculate on the possibility of instantaneous transportation of physical substances from one place to another. Think of what it would mean to be able to step into a transmitting apparatus in New York and be able immediately to walk out of the receiving mechanism in London without having to resort to ships or airpianes. Of course there isn't a single scrap of evidence to indicate the possibility of any such marvelous development, but the 'impossible' has been accomplished many times.

It was not so long ago that Edison's phonograph, presented to the French Academy of Sciences was denounced as unpossible, a rancal's trick of ventriloquism." And in 1843 an official of the United States Patent Office resigned because "it is im-

possible to discover anything new and it is only a matter of months until this office will be forced to close through lack of husiness." Careful people prefer the words "improbable" or "subkely" to "impossible."

When Editors Miss the News

A REFRIGERATOR-PURNACE capable of either cooling or beating a bonze in being developed by the American tras Association. This announcement was hidden in three lines on the inside page of a great newspaper. Displayed prominently on the front page of the same paper was the story of an obliging beating a Kausas town that walked into a farmer's pantry and

laid an egg in the egg crate.

There are 500 000,000 hers in the United States. One made the front page became it did something different. The man who sits for days on a flagpole or goes over Niagara Fails in a rubber ball makes the front page for the same reason. The scientist who makes a valuable discovery also does something different, but he does something that benefits every one of us. However, he doesn't arways make the front page. Some day, perhaps, all newspaper editors will realize the importance of scientific discoveries.

We Need a New Calendar

It present casendar with its twelve months of uncoma length is like a yardstick that sometimes measures thirty-air medies and sometimes thirty-eight or thirty-nine. Movements for calendar reform have been frequent and unsuccessful in the last quarter of a certary. Now, however toisiness uses are beginning to interest themselves in the idea. Mr. George Eastman, of Kodak fame, for example, supports a proposal to divide the year into thirteen months of twenty-eight days cach every month beginning on a Sunday and coshor on a Saturday.

Mr Lastman is right. The business advantages of a year having thereen mouths each of four equal weeks are apparent. Portion Science Monthly frequently has pointed out the need of such a change. Thirteen mouthly settlements instead of twelve would mean a faster turnover, a larger volume of bunness with less capital. Month to mouth statistical comparisons would need have to adjustments for an unequal number of days or weeks. Each year, mouth and week would begin on a Sanday and end on a Saturday. For everybody all calculations of means and expense would be impirited.

Easter could be given a fixed date to the advantage of many liminesses. Holidays such as Christians, New Year's. Withington's Birthday and the Fourth of July would come each year on the same day of the week. The extra month, called "Sol," would be put in between June and July and the 365th day, called "Year Day", added as an extra holiday between Docomber 38th and January 1st. The calendar, the same for each month, would look like this

Sun, Mon. Tue. Wed. Thu. Fri. 1 숖 3 4 8 6 7 13 8 в 10 12 11 14 15 16 17 10 120 181 31 24 25 541

The suggestion meets opposition, for one reason because the thirteenth would always full on Profay. But it will take more than superstation to full the proposal.

They Are Saying -

"TWO big captive balloons, hoisting between them a glass-inclosed platform high into the sonstrine, can core all the tuberculosis in Northern Russia," "Prof. H. Opel, Director, Mechinkoff Hospital, Leiungrad.

"Unless the frenzied efforts of young women to become slender are checked, there will be a marked tubercular increase."

Or Bertram L. Bryant, See'y, Maine Medical Association, "There is a direct connection between the weather conditions in the Antarctic and the rise and fall of the River Nile Capt. Sir Hubert Williams, explorer.

Popularizers who bring an understanding of science and academic investigations to the people have an important place of resolvents of a literature of the people have an important place.

in evaluation's advance." Thomas A. Edison.



The Graf Zeppelin Comes Across on 465 5KF Bearings

A GREAT, gray monster of the skies, lighter than the air its giant propellers thrust astern, pushes its nose through the autumn sea-mists and hangs suspended for a moment above a great city, as though making its curtain call and taking its share of well-earned appliance while millions of upturned faces register their appreciation of the fact that another page has been written in the history of passenger transportation.

An entire world had waited while the five great Maybach Motors sang their songs of progress across the great Atlantic wastes—a world afraid as that other world of 1492 thust have been afraid when three caravels cleared the Port of Paloe and pointed their prows toward a new

and unknown world. And yet, in the one hundred and more cities throughout the world where And F offices are located there was a feeling of hope, of confidence, of behef.

Had not Lindbergh made his historic flight with the help of and Bearings? Didn't they help to carry Chamberlain to Germany, Byrd to Ver-Sur-Mer, Maniand and Hagenberger to Honolulu?

Weren't they on the Los Angeles when she flew on her maiden voyage to America?

And were there not four hundred and skty-five of these same sees? Bearings in the motors and in the other mechanical parts of the Graf Zeppelin?





5KF INDUSTRIES, INC., 40 East 34th Street, New York

2179

How You Can Test Antifreeze



"Pasts this in your hat, "Que suggested. "A glyrerin solution that floats this particular hydrometer at 1,080 will loop Jack Front out of your radiator down to ten degrees."

"Son, "aure do waste a lot of time finding out what they want to know "

The veteran unto me-made despotedly shoved the telephone away from him.

Joe Clark, his partner, who had called him into the office of the Model Garage to answer the phone, gransed sympathetically. "What did that boso want?" he inquired. "If I'd known be only wanted to sak a bunch of fool questions, I wouldn't have bothered you.

"Foney you d'ar t recognize hou." rephed Gas. "That was old Dexter, the
ned who's always spouling theoretical
stuff about calories, thermo-somethingor-other and the rest of it. He d'rather
meso around for hours with a pencil truing
to figure out samething than to ask someone who knows.

Then what's be pestering you for?" Jue asked. "Why don't be figure it out if he's such a shark at it?

"He add task arv mestions granted Gus. "He says he's coming here to get me to help him on some of his blasted calculations. I don't get what he was driving at except it had something to do with specific gravity. I just told him to come shead and I gress he's on his way now."

A FEW minutes later Decter drove up and trasted on bringing his car in aide instead of parking it in front of the garage. It was below freezing outside, he explained, and he was afruid the radiator might freeze

I am sorry to bother you, Mr. Wilson," he said, as he reached into his car and dragged out several thick and musty looking scientific books. "It is just a relatively simple problem in specific gravity. That is, it should be simple enough, but there are several confusing factors that complicate matters."

'What are you trying to do, figure out what makes see float?" anded Gus.

No," replied the other. "You reconmended that I use glycerin in the radiator this winter and I took your advice. The results have been excellent until day before yesterday, and then I unfortunately forgot to open the radiator shutter until the motor became so overheated it began to bod, and I am afreed that a large part of the solution againsted out the overflow pipe with the steam. New I don't know what artually is left in the radiator. I looked up the specific gravity of glycerin and found it was 1.305 degrees at ordinary temperatures. It occurred to me to enterdate the specific gravity of the muxture I was using and then by test nee what I actually had. But these books show that it is rather complicated."

Bt MPED right into a tough one, didn't your said Gus. Theems to me I remember reading some place that a solution is a nu form mixture that doesn't follow the law of definite proportions. That floored you, ebr

"That sit precisely," said Dester, "and now I am unable to find a formula to fit the case. Perhaps you can help me?"

"Sure," Gus replied. "Chuck those blame books back in the car. We won't need 'em. Hey, Bill'" he called to the youngster who was sweeping the other side of the garage. "Chase yourself down to the deng store and buy me a couple of ounces of glyverin and a test tube. Make it anappy."

"Now," Gus explained when Bill returned a few impotes later, "all we've got to do is to take the hydrometer float out of this storage battery hydrometer and see how it floats in different mixtures

Gus, Turning the Model Garage into a Laboratory, Works Out Easy Formula for Radiator Solutions

By MARTIN BUNN

of glyrerin and water. What's the matter with that way of finding out what you want to know?"

"But will the results be sufficiently accurate?" Dexter objected doubtfully

Why bot? 'co intered four.' You is ild wear out a couple of pencils figuring at closer than the paper on the wall, and even then you wouldn't be dead ours. These cheap hydrometers are no great shucks for accuracy. Your figures might be all right and a burn hydrometer would throw you way off. But if you make up the actual mixtures and float a hydrometer in on any old hydrometer you can keep that hydrometer past for tealing your radiator solution, can't you?"

"You've proved your case," admitted Dexter-

"THESE storage battery bydrometers," Gus continued, "don't read much below 1,075, so you won't be able to tell anything about very weak solutions of giveerin and water. Let's start with one part giveerin to two parts water. That's a thirty-three percent solution,"

"Reads about 1,080," and Dexter, bending over to get his eye on a level with the top of the solution, a the test

"Paste that to your but" Gus suggested. "A glyceric solution that floats that particular hydrometer at 1,086 will keep lack Prost out of your radiator down to about ten degrees."

"But we occasionally have colder weather than that in this latitude," Dexter obserted

bometimes." agreed Gua. "Let's see how it reads in a forty percent solution. That won't freeze down to zero. And if we add one third of a part more glycerin to what we've got in the test tube already we'll have mighty close to a forty percent solution."

DEXTER did a bit of figuring while Gus was storeing at the added plyeerin and found that the auto mechanic was right.

"There you are," said Gus, as he jiggled the test tube to make the hydrometer float without sticking to the glass walls. "Just 1,100 on the scale. Nice easy figures to remember. Keep the solution at 1,100 if you want zero protection."

"Excellent" Dester exclaimed. 'Now I have merely (Communed on page 154)



A Radistron for every purpose

RADIOTRON UK-RIT-A

RADIOTRON UV-149 Dente Amerika

INDICTION UII-100

FLADIOTRON WID-LI

MADIOTRON WX-12

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RADIOTRON UE-188

RADIOTRON UX-888

А-ИТ-КИ ИОИТОН**ДА**

RADIOTRON UK-171-A

BUS-XU NONTOHOUS

RADIOTRON UX-448 (Interior Amphilies Inc Management on pitch despitation

RADIOTRON UX-IIBI

PADRITHON UN-889

PADIOTRON UT-487

RADIOTRON UX-300

MADIOTRON UX-MI

RADIOTRON LIX-674

RADIOTRON UV-479

RADIOTRON LIV-MA

The gordend by which other excusion tubes are noted

A radio set that was a Christmas gift last year now needs a Christmas gift of a brand new set of RCA Radiotrons.

To maintain fine performance in a radio receiver, the manufacturers recommend a complete change of vacuum tubes after a year of average daily use. And the engineers advise that all tubes be changed at one time. Old tubes left in mar the performance of new ones.



RCA Radiotron

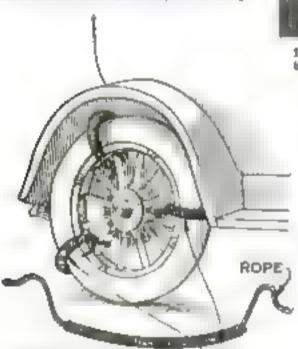
A Kit of Ideas for Motorists

If the Fan Belt Breaks, or You Need Tire Chains in a Hurry, Here's the Remedy And Some Other Handy Kinks

EGLECT to carry a trouble light in the tool kit of the car may cause no end of annoyance on the road at night in the event of some minor difficulty. However, often it is possible to obtain all the light necessary for a small repair on the ignition system or the carburctor by mang a small hand merror to reflect the bearns from the bearleight to the desired point. If no hand mirror to available, moscrew the rear view narror and use that.

Snow Hooks of Hose

WHILE chains of the ordinary type usually will give you traction in energy or mud, it is a dirty



PLECES OF OLD GARDEN HOSE

Fig. 1, Emergency tire change made by threading rope through boor and tying on.

job to apply them. And when most of the route is clear, with unly a short sec tion of road in bad shape, chains will come in for a lot of manecessary wear besides chafing the tires.

Fig. 1 shows a sample solution of the problem. Take pieces of old garden hose and through each piece pass a length of atrong rope. When you reach the had place in the road it is the work of but a few moments to tie them in place as shown. They can be removed with equal facility when the bad part of the road is left behind Pieces of buse attached in this way. are particularly effective in deep. soft snow but they are, of course no good on (ee, where ordinary chains) ahould be used.

Three-Tone Horn

THE note produced by one type of auto burn depends on the voltage applied to it. If your born



If you have no trouble light, one can be improvised by using a small hand mirror to reflect headlight beams.

is of this type you can make it sound three different notes by the use of resislances and buttons world as abown in Fig. 4 at the right.

I'wo rheastata such as are sold for use or hudding radio receivers can be used, As you will note from the diagram, pressing the right-hand button allows the current to flow unuspeded to the born mechanism. Pressing the center button places the resistance of one rheostal in the circuit, and presning the other allows the current to flow through the second

Ten Bollars for an Idea!

August Grosse, of Collinsville, Ill., wine this month's \$10 prise for his suggestion of a novel bushing press (Fig. 2.) Each month Port Lat Science MONTHLY awards \$10, in addition to regular space rates, for the best idea sent in for motorists. Other contributions used are paid for at the usual rates.

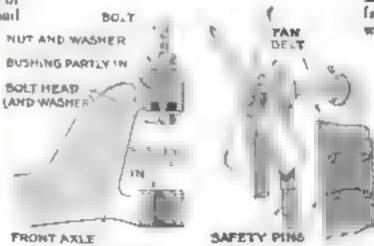


Fig. 7. Bolt mit noch washers are used to prese on a king-pur bushing.

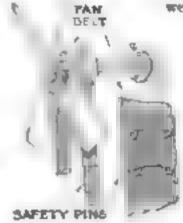


Fig. 3. Fan. belt pared by science broken ends together with pine.

rheostat. The born mechanism may require alight adjustment for best results. The resistance of the cheostata will depend on the current drawn by the horn and how much residence is needed to chass the required change in tone.

Novel Bushing Press

O'VE bolt, one nut, and two washers will permit you to prem king-pin bushings, or any similarly assembled history, into place just about as well as it can be done in an arlor press. And there is no risk of deforming the edge of the bushing as there would be if you prounted it into place. Fig. 2 shows the method:

The built should be a loose fit through the hole in the bushing, and the washers should be some-

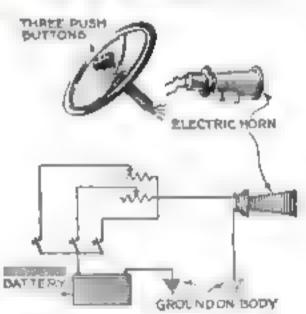


Fig. 4. This diagram shows here to wive hors to produce any one of three tones.

what larger than the outside diameter of the bushing. If the washers are thin, use two or three at each point

Fan Belt Repair

IF YOUR auto motor is equipped with a plain, flat fan belt made of either fabric or leather, it is possible to repair it well enough to get to the nearest service

> station. You will have to loosen the best-tightening adjustment to obtain the necessary slack so that you can overlap the ends, and fasten them together with safety pins, as shown in Fig. 3. If that is not possible, you can pin a thin piece of leather to the two ends to hold them together.

If the distance to the service station is not too far, tying the ends together with a strong cord may serve as an emergency repair. The belt should be replaced with a new one as soon as possible.

BLACK & DECKER Electric Tool Chests

For drilling holes in-Metal, Fibre or Wood-or any material which can be cut with an ordinary hacksaw. For light grinding, buffing or sanding.

Everything at your finger tips when you want it. The automatic tray, which contains the accessories, is sealed tight by the cover when the chest is closed, so that in any position the contents of the tray cannot spill out or get mixed up.

No. I Electric Tool Chest

A heavy metal tool chest containing-

Black & Decker Light Duty Quarter-Inch Electric Drill; Bench Stand for light grinding, buffing and sanding; set of twist drills up to ¼ inch, wire wheel for rust and paint removing, mag buffing wheel, grinding wheel, and sanding due.

> U. S. Price, \$43.50 Canadian Price, \$56.50



No. 4 Electric Tool Chest

The same type of chest as the No. 1 but considerably larger. Contains—

with famous Black & Decker Half-Inch Spectal Ball-Bearing Electric Drill, twist drills from 1/4 to 1/4 inch. wood augers from 1/4 to 11/4 inches and Black & Decker hole saws from 1/4 to 3 inches. The hole saw is a special Black & Decker tool for use with the electric drill, enabling you to bore holes in metal wood, fibre, etc., up to 3 inches in dismeter

U. S. Price, \$76.50 Canadian Price, \$99.50



This is the electrical age. With a Black & Decker Electric Tool Chest you can do better and faster work. Own an Electric Tool Chest and be up-to-date.

Order one of these chests today

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	TOWSO							

Please send me literature on No. ‡ Electric Tool Chest as illustrated and described above, also the names of dealers in my neighborhood where I can see these Electric Tool Chests.

service or measure on any designational activity to contain and preside product to on during

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Setting Up a Bench Saw Table

How to Build a Rigid but Easily Moved Machine Support with a Belt Tightener and a Dust Chute

34160

eliminated. Lastly and most important

By W. CLYDE LAMMEY

HE saw table support illustrated is designed to overcome some of the illa attendant upon the operation of a bench saw driven by a separate motor. Where such an outfit now to be found in many bome workshops—is mounted on a heavy plank or the like, it is difficult to move the a sembly about the shop, to prevent the belt from slipping, and, if the table has the tilting feature, to place the saw so that long stock will clear the bench when culting angles.

A sat sfactory home workshop as any requires some means of tightening the helt quickly and effectively without

having to loosen the bolts holding either motor or saw frame a moniting that subsolutely solidand permanently rigid, especially that part supporting the motor (for a firm have will eliminate in-purious vibration and additional to its bie), and an arrangement of parts that in economical of space.

Having these essentials constantly brought to mind in his work, the writer set out to hald a mount that would embody the required features. Several mounts were constructed and discorded after considerable experiment. The proper-

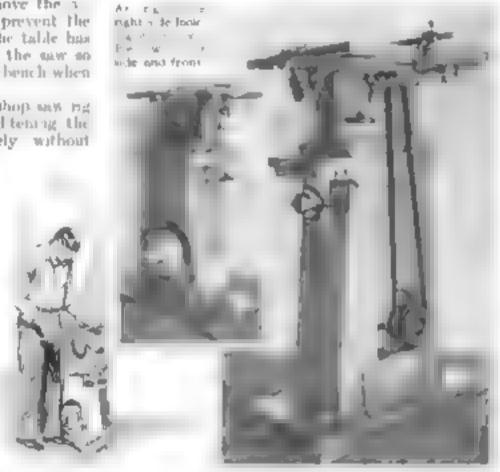
experiment. The principal drawback of all these attempts was the manner of mounting the motor.

The final arrangement is in essential that shown in the accompanying drawings and photographs. It worked so well from the beginning and filled all the requirements for the satisfactory operation of a bench saw table in such a gratifying manner that the statement is here ventured that any man who owns a bench outlit driven by a separate motor will find a notable improvement in the capacity of his saw if he will take the time to construct a mount after this fashion. The entire cost of the mount, including brushing lacquer finish, was found to be less than three dollars.

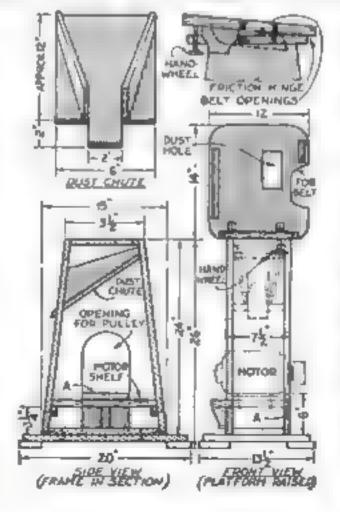
THE motor is fixed permanently on a solid, immovable support yet may be removed when desired. The floor space occupied is but 16 by 20 in. The sawdust is delivered through a chute to the back of the machine, where it may be caught in a bag. The outfit is easily moved, as it rests on sliding casters; and, owing to the distribution of the weight, it will not tip either way. Disagreeable vibration is

eliminated. Lastly and most important of all, the belt tension is always adjustable, even when the machine is running, by the action of a conveniently located handwheel

The drawings should be sufficient for



Above are two photographs of the new table and mounting which above (to compactness and newtaess, below are drawings of the construction.



any handy man to work from. If any one feature of the construction require for ther comment, it is the care necessary in fitting the separate parts. Only simple butt joinery is called for, but mises the surface fits true and tight the strength of

the glue is largely lost and the joints are likely to loosen after a time—a possibility to be guarded against when solidity is the main virtue.

A liberal application of glue should be used on all journg surfaces save the 6 by 6 in, piece marked A and also the one marked B on page 104; these are fastened with acrews only as provision must be made for removing the shelf. When in position the support is held rigidly by acrews. Flat-head 13_{2-in}, acrews are used, the heads being countersunk flush

THE dust chute must be a close fit, secured with gare and screws at a softweent dust to facilitate the escape of the sawdust and clups from the dust opening in the platform shown in the drawings should be located to suit the saw and should be smaller than the opening in the fixed portion below, so that a piece of heavy his scale, taked in the appear opening will conduct the dust

into the chute without allowing it to get between the hinged pieces when the platform is raised.

Attention is called to the center support under the motor shelf, which extends clear through; it should be a good fit and well glued. This thwarts any tendency to spring under the motor's weight and prevents lateral vibration.

Before fastening the sides of the column, it is well to level a place on the floor both ways with the spirit level, place the spount upon it, and level the motor base true with the top which is to support the platform, planing out any discrepancy

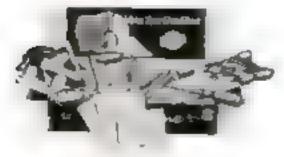
In the upper right-hand view of the drawings on this page showing the hand-wheel, the dotted line is the apron on the opposite side of the platform. This longer apron is shown in position on page 104. These aprons, which fit fairly light over the fixed piece of the hinged part, are to prevent any side sway when the platform is raised.

Two fairly beavy friction binges are used. These must be let into both pieces with some care (Continued on page 10a)



Your boy is safe when he is working with tools and wood

Bet No. 904; 12 toolsonly cabinet. Price \$15.



Set No. 907; 7 tools in cardboard box. Price \$5. This set includes plans for making a tool cabinet.



Bet No. 902; 20 tools oak cabinet. Price \$25.

Fun for him—plus something more—this working with tools and wood.

A chest of tools will keep your boy's mind occupied profitably. Your boy's spare time deserves your thought—your guiding influence.

And—did you ever stop to think—how few toys make lasting gifts? Tools, with Stanley Plans to get him started right, will keep him interested all year 'round—and many years to come.

There are 25 Stanley Plans: boats, dog houses, tables, chests,

work benches, etc. They sell for 10c each at your hardware dealer's. There is, also, our new book "How to Work with Tools and Wood". Your hardware dealer has this, too. You can get it for \$1.

On the left are three typical Stanley Tool Chests. There are 16 altogether, ranging in price from \$5 to \$95. Ask your hardware dealer for catalog showing them all. Or write to us for a free copy of Catalog No. Se35. The Stanley Works, Advertising Department, New Britain, Connecticut.

STANLEY CHESTS

The all-year-'round Xmas gift

How to Build a River Packet



Captain McCann used plywood in building up the trans, but cordboard will error as well

N TWO previous articles we described. how to make the hull and many of the fittings of the stern wheeled Buckeye State, a passenger and freight Mississippi steamboal of 1878. Those who passed these series, yet wish to build this picturesque and now most popular type of model need not heatate. They can obtain the two back numbers of the reagazone (November and Decemher, 1068) by sending 50 cents to Popular. Series a Monther, 250 Fourth Avenue New York City, and, what is more inportant, for seventy-five cents they can get three blueprints which contain full size deawings of the finabed model and views showing it at various stages of the construction. These blueprints are Nos. 94, 95, and 98 on the list on page 105.

Herbert and Edward Quick in their hook Musiumppi Steambootin' have a good word for this class of craft;

"These steamhouts were the craft that scame numetimes called densively 'Steam engine on a raft.' Without doubt their low flat hulls and towering upperworks looked queer and unsubstantial to a sanor's eye. But the steamhout at her finest was the product of a long line of evolution. She was developed to meet a

You Can Begin Now to Construct the Latest Type of Ship Model, Even if You Missed Our Preceding Articles About the Buckeye State

By E. ARMITAGE McCANN, Master Mariner

34702



act of conditions and needs and disappeared only when the conditions changed and the needs were met by other conditions. The steamboat carried the freight and passengers and she carried them fast. She was beaut ful with the beauty of a thing that fulfills its purpose well. In her own way, her lines were as true and clean as the lines of a yacht And her speedy water transport of today."

Our particular boat was a smart one with her speed of fifteen index an hour in dead water. The Eritpie, which was the fastest river boat ever built, had a speed of sixteen index upstream and twenty-five index downstream, but she was one of the racing side-wheelers. Though our boat had not so much wood scroll and fancy work as some (for which we may be

thankful), she was about as typical as possible of a class that started in 1813 and still continues.

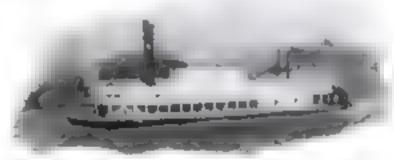
Our model has now progressed to the point that its deck fittings are in place. The next thing required is the boder deck. I made mine of ½ in thek holly wood, but any other light colored wood will do, such as high or pine. It might

even be made of heavy cardboard such as five-ply Brutol board, or two thinner sheets gloed together; if that is used for the decks, they should have for stiffening some wooden crombattens, placed underscath where they will not interfere.

t at the deck, which is \$44 by 10% in , to the outline shown on the deck plan reproduced on this page and shown full size on Blueprint No. 95, at the same time make the upper deck exactly the same size.

Lay the builer deck on the engine room, anoke box, and bulkheads, and see if any of them needs sandpapering down to allow the deck to be flat and conform to the sheer of the built

Now cut the boles for the ladders to project through. The central ladder goes up to the interior of the cabin, so needs no apparent opening, but rectangular holes



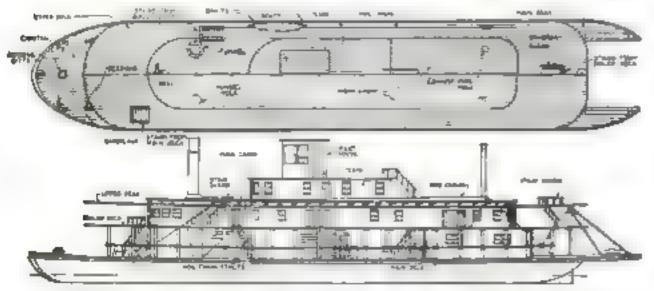
Model of the Buckeye State mounted on ripple glass with a scenic background. Other photon will be published fater

14 in, wide by 54 in, long are necessary for the forward ones. Mark the deck planks.

Glue the boiler deck down and aid the glue with a few brads. To support its edges, there will have to be a row of posts on either inde. For these make some strips of semihardwood, a scant ¾ by ¼ in, in cross section. Cut it is lengths to fit exactly between the two decks, from the extreme edge of the boiler deck to close inside the edge molding of the main deck. I made mine a shade long, bound them into a very tight bundle, tapped all the ends level, and then sandpapered the other ends level to the right length.

Give these in position % in apart center to center. Bore holes through the deck above and below, and fasten each one, or at least alternate ones, with pin points. The forward ones are set a trifle in on the lower deck.

For drilling fine pilot holes for pins, mails, and other (Continued on page 102)



Top view and side elevation of the model to show the construction of the holler deck, upper deck, and main cabin. The wheelhouse and a few other fittings shown will be discussed in the next article.

C&L 32

This is one of the most popular blow-tweeker we have over made. It is more expensive than the ISS because it is made for much harder are. It is designed for the more who over a blow-torch to his daily burears and demands not only excellent performance but rayged ability to stand rough harding. 12 contains the most advanced patented E. & L. blow-torch improvements, its line has a red bandle with the gold stripe. Sure sign of satisfaction.

ARE YOU PARTICULAR ABOUT YOUR TOOLS?

spring on the pump-valve gives you more positive

"You bet your life I am," you say, "When I buy a tool it's got to be right and it's got to stay right."

When you buy a Clayton & Lambert torch you're putting a worth-while tool on your workbench. The most exacting blow-

torch uses are considered in the manufacture of Clayton & Lamberts. Lasting materials—the strongest available, selected for long, efficient use. Many of the features of design are exclusive and patented Clayton & Lambort improvements—the result of 40 vests' experiment and invention. And Clayton & Lambert torches are made by precision workmen. Men who think of tools and look at tools in the same light as you.

The handles, for instance, are fastened so that even excessive strains won't make the tank leak. The double





C&L 158

This biom-tooch is especially made and perced for the man who takes to do add jubs around the bosts or to traker with merhanical through, It will that a systems of mechanical chings. It will that a cretime of it is not obused. The single retail price to about five dallars. Most hardware rice trical and antomobile accessory stores have if— or can get it for you quickly. Look if the red handle with the gold strips.

compression and lasts longer. Even a part like the filler plug is given extra thought, resulting in extra value. We've put a lead washer in there. You know that'll outlive a leather one by years.

In the No. 32 torch the control valve is designed to prevent you from carelessly spreading the gas orifice. Yet when you close this valve you automatically clean out the orifice.

Things of that sort have made Clayton & Lamberta the largest selling torches in the world. There's satisfaction and pleasure in working with such a fine, capable tool,

You can buy Clayton & Lambert torches at hardware, electrical and automobile accessory stores. Look for the handle—it's red with a gold stripe. But to be sure-look for the trade-mark too. It pays you to be certain that you're getting a Clayton & Lambert.

Manufacturing Company

Detroit, Mich.

Mounting Your Lathe Work



This job looks to be well belanced: estually It is better if set up as in Fig. 0, page 109.

VEN skillful machinista expensence difficulty at times in two classes of lathe work-that which requires high accuracy, and large, heavy jobs which may exceed the capacity of the

In many cases the trouble is due to distortion enused in the spinisle and faceplate. by strains imposed in clamping and through the weight of the work itself. Sometimes they are recognised for what they are, but more frequently they are not, and for this very reason seem intractable. These disturbances of the spindle assembly are complicated occasionally by muslignments in other parts of the lathe; then it becomes doubly important to know what they are and how to overcome them in order to prevent the "pyramiding" of

When we want to get a piece of fine work just right, we indicate the faceplate to make certain that it runs true. Some of us who have acquired wisdom by expemence might decide to take a fine cut off it after it is in position. Yet these precantions are likely to be all in wan, if the work is clamped as at A in Fig. 1.

Why? The explanation is seen at B. By disposing the clamp a as has been done, the faceplate is put under a strain which deforms it all around the area of the bolt, as shown at 5. This may seem unlikely, but we need only consider that it is easy to exert a pressure of seven or eight hundred pounds by anoderstely Lightening a 14-10, bolt and to imagine such a load concentrated on the unsupported web as graphically indicated at C, to realise that the web must be deformed under such conditions.

It is true that when the holts are drawn

Hints on Setting Up Awkward, Unbalanced Pieces to Prevent Distortion and Vibration

By HENRY SIMON



up lightly no appreciable distortion may result. When the claimping is even all the way around, too, the bulges raised may be symmetrical enough to offset the disaligning effect. But it does not pay to rely on the providential operation of such things when it costs nothing to clamp

right and prevent trouble.

If some clamps on hand have been provided with a slot or a row of holes as suggested in the first article of this series (Dec., 1928, some), it will be easy to move the bolt up near the work so that practically the entire strain developed will be one of compression of the faceplate and work, as indeed by rights it should be. If the strap is long, it may be used as at D. although in heavy clamping it would be better to apply it as at E. Ordinarily, of course, the best way will be to use a short strap, as at F

Oversonally the work has overhauging projections which do not allow the claimp holt to be moved up near the footing. In such cases, distortion of the faceplate is

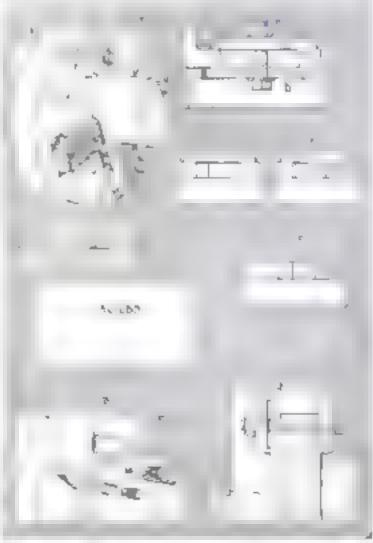
avoided by using a second strap. parallel to the top one underneath the web, as in Fig. 2 at A. In this manner, the bending strain falls entirely on the two straps, and the fareplate and work are under compression against each other only Light work of this kind can sometimes also be held by annall (clamps, modified as described in the previous acticle and shown applied at BBeing light, these clamps are not likely to be overtightened, and for this reason alone are nient for many kinds of deficate

TOROPER belancing is a most I important factor in holding many lands of unsymmetrical or offcentered work. That as universally recognized by mechanics, and considerable care is sometimes expended in balancing a set up. The many puzzling and exasperating errors which nevertheless occur such as taper, oval, and out-ofround bores and turns, are blamed for the most part on other causes, if they are expenined at all. How can the fault be with the balancing.

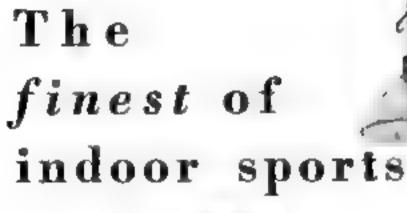
when we had just seen with our own eyes that the piece war balanced as well as

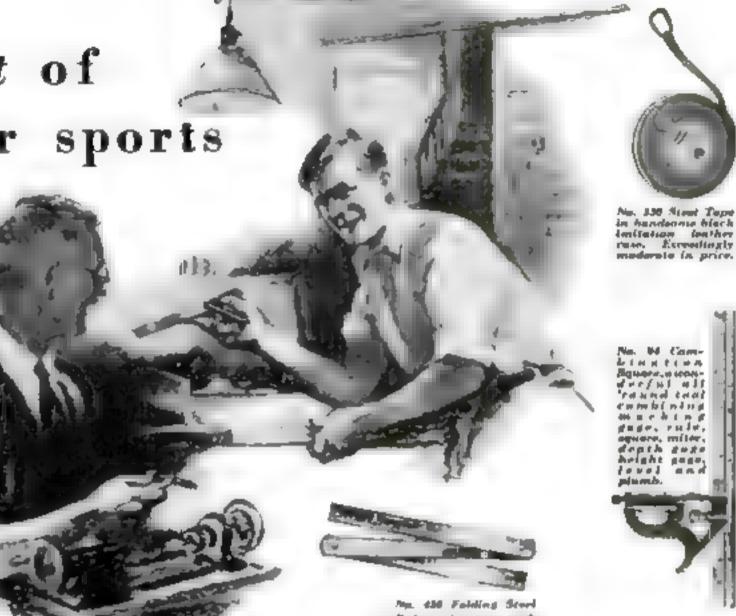
Nevertheless, the fault is with the balanong more often than not. The custing shown in Fig. 5 at A and B is the same in both cases, and is in both cases balanced by the same weight, in the same manner. and with the weight in the same position. In either case, with the spindle free, it will be absolutely at rest in any position. Yet the set-up shown at A will produce a true bore, while set-up B will probably vibrate and the bore will be as shown exaggerated at ('

The expanation lies in the difference between what is technically called static and dynamic balance. In planter langaage, we might say the difference in the balance of a part while it is held still and the balance of the same part while it is rapidly revolving. It would not be far from the truth to may "imaginary" and 'real" bulance, because when we are balancing a thing (Continued on page 100)



Why a faceplate is distorted by the improper use of chumps, and two methods of clamping work with projections.





State, spring-resegreest. with colored figures and

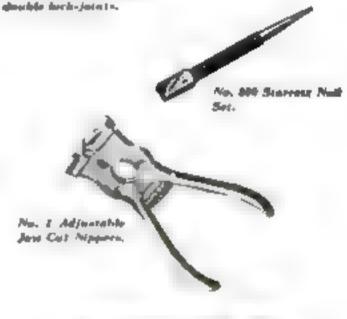
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No. 153 Planel Grip Machana Frame with Scorrerr Blade, quick-cutting. iong Read.

"This Helped Me in My Work"

Expert Machinists Give Shop Hints

A MY experience of sixteen years as a toolmaker and four years at tool deagning, I have never seen a better tool but holder than that illustrated in Figs. 1 and 2. I made one for myself and find it saves time to be able to pick up at once the exact tool bit needed instead of having to search for it. Usually the last one that you pick up is the one you need.

The holder has places for twenty-twotool lats, which are held so that one can

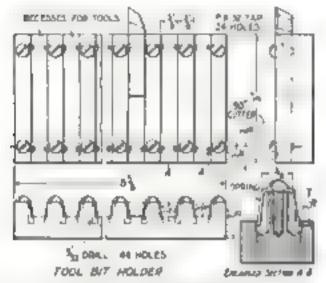


Fig. 1. The holder to a slotted shimmour plate with steel wire springs to retain the tool help.

see their shapes at a glance. The base plate is aluminum. For a holder of the size shown twenty four round-head hard No. 8—38 screws and the same number of pocestof spring steel wire will be found necessary. Grance V. McCulley.

PENDING the arrival—some weeks off—of a regular broach for use in a broaching machine, it was necessary recently in a large shop to finish a number of blanks which had been roughed out, ready for broaching. Several attempts at hand broaching resulted only in breaking broaches. The foreman then designed a means for supporting both work and broach and broached out a hundred blanks with a single broach, using an ordinary arbor press for his machine. The device used is shown in Fig. 8.

The large knurled sleeve supports the blank (which for clearness in illustrating is shown protrucing slightly from the

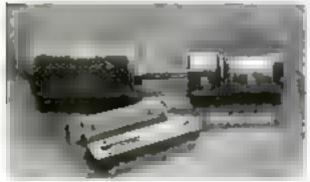
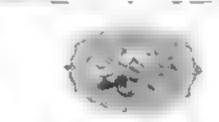


Fig. 3. Fixture for broaching work on an arbor press, and a spring tool for making graduations,





Old Bill

Says-

If THE boss gives your neighbor the best work, look up a good reason before you begin to criticise him.

To enfequend the end of a piercing punch for tempering, it is advisable to make it with a male center.

If you have to change the cutting edge of a good drill for a brass job, regrind it before you turn it in.

There are only two ways to use a monkey wrench and one of them is wrong.

High speed steel can now be hardened in lead at 2,500° F.

While waiting for an extralong cut to go through in a lathe or milling machine, it pays to review your machinist handbook.

Sperm oil is excellent for fubricating a high-speed spindle.

Don't use your lathe for a straightening press. Jamming a crowber between the work and the cross-feed table will cause you trouble in the end.

If you are not familiar with the sensitive touch of a vernier caliper, have someone else take a reading also, and see if both correspond.

A Tool-Bit Holder and Other Ideas

sleeve) near its lower or left-hand end, while the first member A of the group at the right fits in the upper or right end of the main sleeve. A thrust hall bearing comes next, which enables the broach to follow the lead better, made the pressure takes place through A and B from the ram of the arbor press. The stem of the broach fits in a short bole in the part A, and the leading end of the broach is entered in the blank.

When the pressure is applied upon the broach, A is well within the main sleeve.



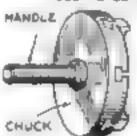


Fig. 4. A plug for protecting the acrew thread in the spindle hole of a small lathe chuck. It also makes a convenient handle.

The result is that the broach has every chance to perform its work. The broach which did the work is good for another hundred blanks, in case the proper broach should not arrive in time for the next lot

In the same illustration is shown a spring graduating tool. Some hardened disks all finished, were required to be graduated. This seemed to call for an etching process, with lines are mately marked for position as well as for appearance. A rigid tool possibly might have been used, but the operator suggested a spring tool of the construction shown. It worked to perfection.

The cover plate has been removed so that the design will be more readily under-

stood. A small cross slot in the cutter engages a small pin in the right end of the cover plate and aliows an adequate amount of movement, at the same time preventing the cutter from escaping from its pocket. Four screws hold the cover plate to the cutter block. The pin at the left of the cover plate is the stop for the spring. In opera-tion, the tool is



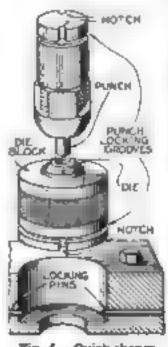


Fig. 5. Quick-change punch and the bolder-



ence has taught them that they can trust these fine measuring tools to avoid mistakes.

> Micrometer No. 62 illustrated above (range 2" to 3" by thousandths of an inch) is one of more than 2300 tools listed in Catalog No. 30. Get a free copy from your hardware dealer or from us. Dept. P. S., Brown & Sharpe Manufacturing Company, Providence, R. L, U. S. A.



WORLD'S STANDARD OF ACCURACY

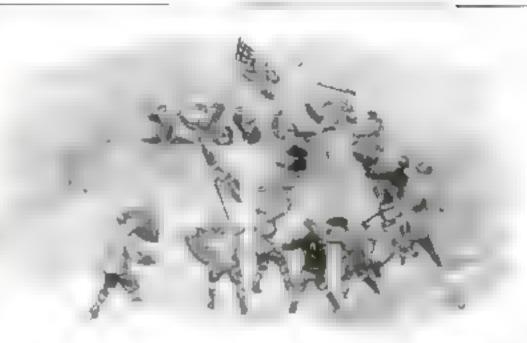
. onsbununon

Planerand

No 615

Rule No. 306





Among the most thrilling sports of winter are the buybood bettler around a snow fort.

It's Easy to Build an Igloo

And a Big Snow Fort, Too, if You Use a Wooden Form to Help You Press the Blocks into Shape

By J. V. HAZZARD

TH Commander Byrd and Scout Siple facing strange adventures in the Antarctic, it is safe to as-

sume that a humper crop of "snow houses" will be built this winter by American boys after what they maagains to be the latest styles of Eslumo architecture.

In many parts of the country, however, there is seldom enough snow of the proper consistency for cutting iglos blocks. Suitable blocks gan be made, nevertheless, if a form such as illustrated below is knocked tagether

The material used is 14-in, white pine which should be well painted, sand papered, and variabled before assembly

so that the pressed block will not stack to the form Sidepieces 4 by 1844 its. are prepared and carefully squared, and batters 34 in square are screwed or nusled across them just maide the ends. The end preces are squared to 4 by 7 in, and fitted with books to hold them in place.

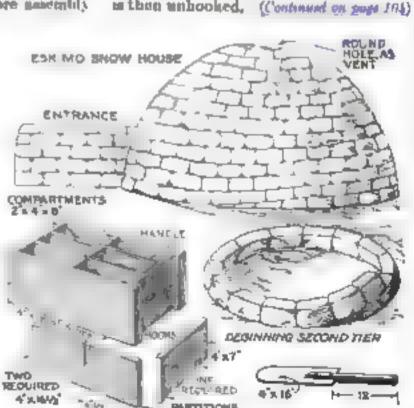
division pieces (for use when bricks of small size are to be made) are 4 by 1816 in. In the center of each, a slot 34 by \$ 10, is cut to take the centerboard, which is 4 by 7 m. and is slotted at 2-iii. iiitervals to interlock with the long preces.

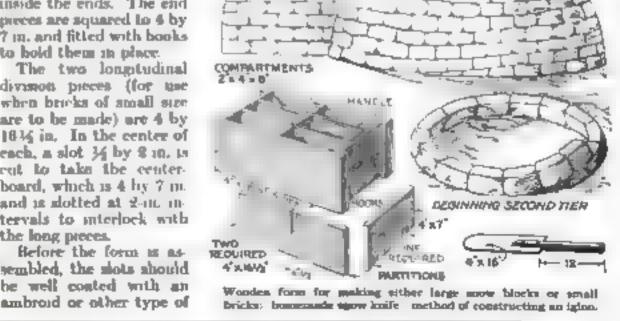
Hefore the form is assembled, the mots should he well conted with an

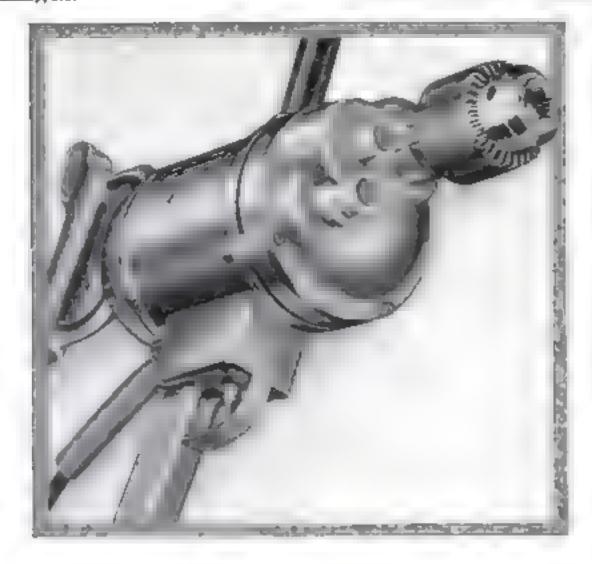
waterproof cement or glue, and long, slim finishing male should be driven at suitable intervals to strengthen the joints. The wire bandle, while not indis-

pensable, is a convenient addition, and it is little trouble to staple it to the center member of the brack form.

In use, the form (without the partitions) is placed on a board of like material, on a coment surface, such as sidewalk or drive, or on smooth see, if the structure ss to be near the shating pond. Boow is shoveled in until the form is beaping full and then is packed until the block will bear the weight of a hundred pound boy with just the sign of a track. The form in then unbooked. (Continued on page 194)







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MILLERS FALLS Electric Drills





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What distinguishes this set-back cubinet from ordinary designs is the way it is proportioned.

Cabinet -1929

How to Build One of the Simplest Yet Most Characteristic Types of Modern Furniture

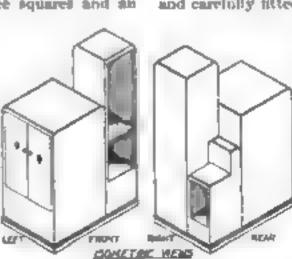
By HERMAN HJORTH

THE modernistic cabinet illestrated was designed by W. H. Varnum, Associate Professor of Applied Arts at the Univeruty of Wasconsin, according to certain principles formulated by the late Professor Hambidge and described in his book Dynamic Symmetry

Suggestive of modernistic "set back" architectural design, it is an outstanding example of a style of furniture that commands high prices in the leading depart ment stores. Unlike many of the new pieces, however, it is not too extreme to be used in a room with ordinary furniture. and it is not ungazely in proportions. In fact, it is no higher than a dining room table and it remires a floor space of only 11 % by 18 m.

The structural features, which may seem rather confusing at first glance, become sample when taken singly. The plan yiew shows three squares and an

oblong placed in a certain relationship to each other. The smallest square and the adpacent oblung are here considered as one mut (C in the drawing on page 100). We then have three units, A B and C. Taken singly their construction does not present any unusual technical difficulties.



Lifer a modern skywroper the piere is its teresting from all versports, even the rest

To build the piece few tools are required. The following will be sufficient: Rip and crosscut asw.

cule, try-square, framing square, park plane, 14-inch chisel, brace, auger bit No. 6, gunlet bit No. 6, screwdriver, hammer, nait set, calmet sersper, marking gage, moter box, expenter's clamps.

As the material is all by no an thickness, it compaties matters to use ply wood exclusively in the construction. I not A is simply a square box \$1 \square high with two doors in one of its wides. Get out the sides, back, front, shelf, and top of A according to the bill of materials. Glue and unil them together. Take particular care to have the corners perfectly square, otherwise the units will not fit when placed together. Smooth all points, round the upper edges as shown, and glue the 14 in. thick piece to the top.

The doors also are cut from plywood and carefully fitted and hinged with 14

> by 116 in, butt hingra. Two ball friction catches, such an are used on phonographs and radio calenets, may be used as locking devices. and two knobs asso are needed.

> Ints B and C are constructed in a similar manner. after which the three are placed

> > f automated on page Ithis

New Big Exclusive Features in the 1929 Model Electric Handi-S



New Features of 1929 Model

found exclusively in the "Delta" Handi-Shop, in add-tion to the many regufar excusive advantages, make this shop use of the finest values in the workshop field. A few of the new improvements are

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Make the Things You Have Always Wanted to Make

With this convenient, practical workshop Itaso early and so quick! Save money on repair work. Earn money in your spare time. Complete natractions furnished. With each Bandi-Shop is included, at no extra cost, complete set of working draw non-Below are a few of the hundreds of artities you can make in a .. ify with a Handi-Shop.



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The DELTA Handi-Shop is a man-sized, motorized workshop, complete, efficient and PRACTICAL IN DESIGN! Does everything from building full-sized furniture, turning table legs, to finishing delicate detail work, Study the illustrations carefully. Note the two-shaft motor that permits two or three operations et one time-the heavy Triple Foundation L. Shaped Lathe Bed (no rods)—the practical arrangement of the Circular Saw that permits the cutting of large lumber without interference—the Improved Tilt ng Tables on the Circular Saw Sanding Duc, and Jig Saw, with many ex-clusive features. Has automatically oiled bronze bearings. and is completely assembled on bravy veneered wood base.

This combination of advantages, plus many more, IS FOUND EXCLUSIVELY in the DELTA HANDI-SHOP! No wonder even last year's Handi-Shop was an outstanding value And now, with the many additional exclusive features of the new 1929 model, this shop is in a class by traif - above all comparison - at a new price that is surprisingly low !

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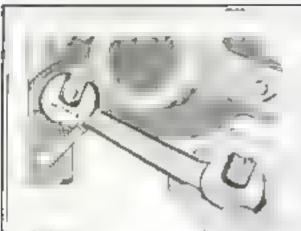


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How to Build a Cabinet-1929 Model

(Unstrawed from Jose 95

together as shown in the various views and isometric sketches. Correct any unevenness and screw them together Smooth all joints with plane and scraper

The base molding is made of 14 in. thick plywood. If a small circular saw is

available the moldog strip may have a
small recess \(\frac{1}{2} \) in,
wide and \(\frac{1}{2} \), in, deep
out into it, otherare the groove may
be made with a combination plane, or
the strip may be left
plane. It should be
rintered at the corners.

Because the edges of the plywood show to desidvantage in various places on the cabinet, it is best\u00e41 acquer or engine thus piece of furbiture. The outside anriace may be painted in a rather light color, and the edges around the openings outbood in a darker shade of the same color, or in a metallic color like silver or gold. The made auriace should he painted to contract with outside.

IF YOU have proced any modernistic furniture at high-class furniture or department stores, you know how expensive it is, yet any man or boy who is willing to take a reasonable amount of pains can build fine looking modern

pieces suitable for use alongside the best commercial furniture. Because of the very suitable of the construction of these pieces, it is esserted, however, to start with a particular.

It is infinitely harder to design modernstic pasces than it appears to be, and the finest craftsmansh n wil nut save a poor design, For that reason all the modernistic designs in the PostLAS SCHENCE MONTHLY Blueprints Nos. 88. 91, 93, and 100 (see page 105) have been prepared with the advice of Professor Varnum, who is an outstanding authority on problems of uni intrial deorga.

Cutting List For At 1114 2044 Side 1034 2012 Back 1014 图标法 Front 1013 Shelf 1013 5 1 2 Doors 14 111/6 1136 Top 111 11113 11/ 2H24 Mark 211 4 世山 Front $6^{1}4$ Shelf 524 ≒ել-∭ ff 4 Top Top Mar (£57 . Malera 5 1 15 4 Back Front 314 Front 530 Shed 401 Top Top Top Top All dimensions are in inches.

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A FRENT AND BEAR	The same of the sa		DE BOOK PARTEM.
* ****		ž.,	
7 - 54 - 10 A LEFT -	*	as a sem	or o is

The cabinet is made in three separate units marked A, B, and C, which are then secondled as shown in the plan view in the upper left-hand corner and in the views of the completed piece at the right,

A GUIDI

or remains a second or an

dr. e. ur. scumPA

Meral or wood compact.

ra spece a walnut or n w shaped a ser

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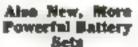
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Marine Engines Complete Steam Engines.
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This bookiet has many pages of information useful to modelmakers, model yachtsmen and others on sailing Model Yachts

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Parts of a sailing vestel spars, eigeng know, hatches and splices commonly used on boats

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How to Build a River Packet

(Continued from poor 90)

purposes, the hest thing is a fine twist drall, of which a great range of sizes may be bought at any large hardware afore or jeweler's simply house. These drals are set in a draft was handle. Substitute dralls can be made of the smallest steel crochet books. No. 14, by grinding off the books and bringing the end to a V-point.

When these stanchions are up, nicely vertical and even, put the handrail on A_3 in, above the deck. A piece of handwood A_6 by A_6 in, half notched to take the stanchions, is the hest the the strip in position and mark the location



Main cabin and letter. To show the orbit more ricarly, the upper deck his not been placed.

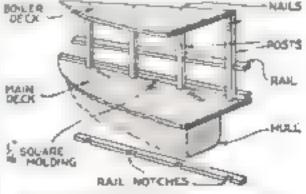
of the notches from the stanchions themselves, not by measurement. Glue it in position and drive an occasional pin point.

The Buckeye State had an elaborate system of hog chains, which, on the cantilever practiple, prevented the ressel from hogging, or drooping, at the ends. The parts that can be seen and should be embodied in the model are shown on page 90 and on the bluepeints.

At this time we shall put in only the strutfor the boder chains in both sides of the boder, the chains from them, and the piece of Main Chain No. I that shows. The struts are been square wood, and the chain (really from back).

To place them, hore been holes for the sures. As boder deck and smaller holes for the sures. As there is nothing to disturb them, they will not need to be secured in any other way. But the upper ends off bush with the deck. They might be white, but I made all my hog chains black for emphasis.

The next requirement in the main calin house. It may be a solid block or he built up hollow. I made the main calin solid, the texas, which is the calon above, of \$6-in, there-ply woods and the pilot house of two layers of



How the posts are set up between main and beiler deck, and how the handrad a matched,

Bristol board. The three-ply method is a lot of trouble and not so satisfactory when done, so I will describe only the other two methods.

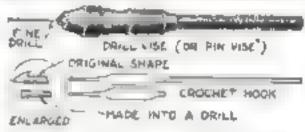
The difference in appearance between the solut and the hollow method is that with the latter the windows can be of transparent celluloid washed photo films or open and the doors can open, tevers og ats interior, if desired However, a solid block is substantial to build with, so I suggest making the main cabis in one piece and building up the terms and pilot houses.

The solid cabas house, then, is a block of wood $R_{\rm p}$ by $2 \frac{1}{2} \frac{1}{2}$ by $11\frac{1}{2} \frac{1}{2}$ in. The front end is rounded to about I in back, and the after end is square, with only the corners rounded. It will be planed both above and below to conform to the sheet.

It is enameled white and the doors and windows are pointed on. The gratings under the funnels are to ventilate that part, they can be thin gilt strips on a blue-black background. The windows should be pointed a light blue, streaked across with a little white, and have white crossbars; the doors may be manageny color with white punchs, and the windows also may be outlined with manageny. Small pin heads will serve for door handles.

It will be noted that the apper deck is placed by in below the top of this move, so that a row of skylight windows shows above the deck everywhere except over the ventilators.

The other method of making a deck house in to cot a piece of wood of min ar shape but only about a so thick. It should be less in use alaround by the thickness of two sheets of thin



Small holes are drilled by hand either with a sweet drill or a modified storl erorbet book.

cardboard. Around this fit two pieces of eardboard of the right height (not forgetting the sheer) to give a double-thick wall. On the oner piece leave tabs extending to be bent in so that the roof may be glased to them. Mark off the windows and doors and glue the pieces together along the bottom only, while holoing them in position around the hairs. Have the position of ferent positions, but do not glue the ends together

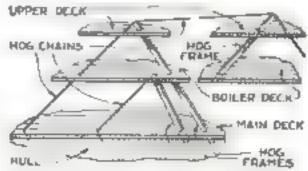
When the glue has set, cut out the windows through both pieces, but cut out the panels of the doors in the nuter piece only. Spread glue on the music of both pieces of cardboard. Put the thinnest obtainable gelatin or celluloid between them where the windows are and fasten them transfers.

Paint in the mish bars, glue the sides to the base piece, and glue the overlapping ends together, making sure that the walls are upright. Erect a few cross bulkheads thode to stiffen the whole. Give the cabin at least one coat of white enamel misde and out, with mabogany true as desired.

Lay the cabin upside down on the upper deck and mark its outline. Out the center of the deck away so that it will fit tightly over the house in a position is in clown from the upper surface. Thus the course firmly in place.

Mark the deck planks and give the upper and toder decks a time coat of variable but do not yet put the upper deck in position.

Next month we will lay the upper deck and proceed with the superstructure.



How the bog frames or struta and the rhains are set up. Their location is shown on page 90.

Makes Paint Sprayer at Small Cost

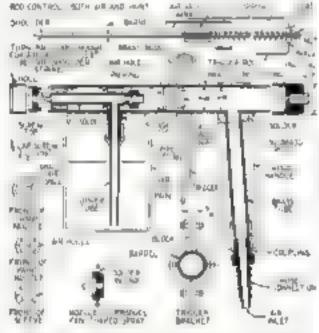
HAVING
many small
paint jobs to do
about the shop
and also desiring
to repaint my old
ear, I looked
about for a good
paint sprayer.
The cheap ones
did not come up



Homemade aprayer controlled by ingger

to my alea of good mechanical design, and the more expensive did, not at my purse altrahaying elathe and do at my disposal pulsas air apply to med I could use. I could as a special it is trained.

I desired a toray with a trigger for controlling both the a rand the flow of paint as the cheaper aprays, which give no control over the paint flow, are continually chagging up with paint dired on the nozale. As shown, I incorporated as



How the point oprayer is made. The trigger controls the flow of both six and point

working parts in the barrel of the gon, which is a 7-in length of bruss tilbing. Moreon in inside and Time in outside character. As these diameters are only approximate all fits have to be more exact when the parts are turned. It will be seen that the point on the valve rod must be turned back far enough for the valve to seat before the shoulder strikes.

The spray is well balanced, easy to handle, and does a first-class job. As many different knows of nonder may be made for it as desired. For all ordinary purposes, however, a properly controlled plain round spray is sufficient. The pressure should not be more than 40 or 50 pounds.

If a separate nossle is desired to produce a fun-shaped apray, it can be turned and drilled as shown, but care must be taken that the air columns marked A and B converge exactly to the point C Solder their outside ends.—J. D. George

THERE is never an excuse for breaking the ends of a board with a block plane. Every stroke of the plane across the end wood should be stopped before it reaches the farther edge.



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Setting Up a Bench Saw Table

(Confinued from 2007 68)

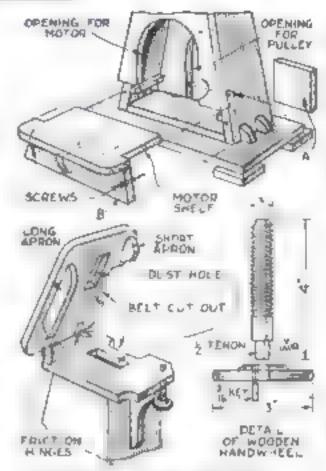
so that when dropped flat the table will be level both ways. Ordinary butt lunges might be used if carefully fitted, but they will not as effectively overcome the slight vibration resulting from the high-speed operation of the

If the table has the tilting feature, core should be taken not to get the platform so use as to interfere with the stock when it ted to a full to degrees. The dimensions given are arbitrary and should be adapted to the saw table and

The action of the landwheel is to raise and lower the saw and the upper half of the piatform to which it is holted, thus Lightening or stackering the belt at will. In this case the wheel and serew are made of wood, threaded in a 1, in screw box. The spindle carrying the thread was turned from a piece of maple with a by by a in round dones or tenon left on the end as shown. The wheel was turned and dulled reparately draven on the tenon in gore, and keyed as shown with a best dowel red. A smalar thread was tapped through the lived section of the pastform, after a piece of herb maple had been let into the platform to receive the tapped hole. This thread was tast indefinitely if greated occasionally

If the worker does not have a serew hay and does not care to invest the very nonmal or a required for a good one, it is possible to accompand the same action with an iron handwheel and not, the not being jet into the wood and the end of the threadest part bearing against a piece of metal fastened to the lower side of the platform

With the exception of pine and the other very will would, which will not do at all, the selection among the hard and near-hard would be a matter of choice; but, of all that might be used, sound gummood is the author's choice.



How the motor support or shelf is built in a removable said, the belt tightening device.

It presents a better than average surface to the glue, holds the screws well, and, when thoroughly sandpapered and given two coals of brushing lacquer over a suitable primer, I presents the present appearance to metal that may be had. Two I by 12 m. by 12 ft. gum boards, or an equivalent amount, will be ample

It's Easy to Build an Igloo

(Cantinged from togs 90)



Typical morehall shields, which can be made from burnel brade or staves and pointed.

the block shoved to one side, and the process repeated until a sufficient number of blocks are at hand. With these blocks it is surprisingly easy. * a both! a true Faximo igloo

First draw a curele on the snow with cord and stick. Place a line of large blocks about the excise fitting the ends closely together

You will need a kinde to trim the ends of the blocks so that they may fit without "chinking. A large butcher kinde will do, or a slat of hardwood may be whitten to a sharp edge, but by far the best instrument is made from a piece of cold-rulled steel 1/2 by 4 by 16 in. as shown on page 26.

llefore starting the second row of blocks, one of the first row should be cut through to the bottom an uscheated in a sketch on page 00 and the adjoining blocks whattlest away not a they form a stanting base up which the second-row blocks can e amb evenly. The bottoms of these are shaved sogithy to give them a unaform toward tolt, and their ends must be beyond to fit one another chooly. Each block rests against the end of its ring, for and is prevented from fazing reward because its outer face is larger than the inner

From here on construction proceeds merely. The tiers of blocks go spirally mond and cound the uploo and the bottoms are trimmed more and more as the rounded top is reached, where a small round hole is left as a vent.

The igloo is conspicted by cutting a door at the desired point and constructing, if desired, the usual low arched passage may. I over the vent and place a lighted oil heater inside for an bour or two, or until the roof of the igno shows signs of melting, then remove the stove and open the vent to allow the escape of the heat. The walls and roof will soon freeze, and the costing of we will prevent show from failing.

The large blocks are also excellent material for the facing of snow forts. Small bricks, made by using the partitions within the main form, are piaced on top of the rumparts.

And speaking of the assault excellent shields can be made from barrel heads or staves as shown on this page

Blueprints for Your Home Workshop

OUR buseprints can be obtained for 25 cents a sheet. In some cases there are two or three sheets to one subject. The blueprints are complete in themselves, but if you wish the corresponding back issue of the magazine in which the project was described in detail, it can be had for \$5 cents additional so long as copies are available. Other subjects besoles those below are to be had; send a stamped envelope for the complete last.

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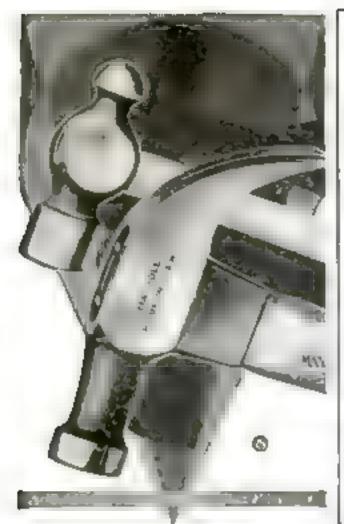
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Furniture Polishing Secrets

How to Restore the Glow to Dull Looking Antiques—Removing Spots and Rings

By R. C. STANLEY, Expert Furniture Restorer

been offered at the discourage of the wood, as suggested in the November issue, the grain of the wood, especially in dark wood, may appear white. This is nothing to be discouraged over; it proves that the grain has been well filled with the wax, as should be the case.

"White grain" is easily climinated by rubbing the piece down with either raw or holled lineed oil or with a good furniture polish. Polishing does not remove the wag from the grain.

There are also times when wood that has had undue exposure to the weather will look "ack" and lifeless after it is oiled. The life, or deep luster, which the



Fig. 2. How a cabinet acroper to sharpened by elightly turning over the edge with a burnisher or any sell set.

would should have, may be restored by a modification of the French polish

To apply this polish, make a rubber (large enough not to cramp the hand) from cotton cloth and apply a good grade of clear varnish to the rubber with a senall brush or swab as shown in Fig. 1. With the finger tips or a very small brush or swab, add a few drops of raw inseed oil to the center of the varuah already applied. Then rub the wood with a circular or across-the-grain stroke. Repeat the application of variath and oil as often as necessary and rub well until a good coat of varnish has been applied. It will be noted that the fine color in returning to the wood because, with the aid of the oil, the variish is being rubbed into the wood instead of onto it.

When the color has been restored, true must be allowed for the varnish to dry, and the presence of the oil will probably prolong the process. When dry, the precedent appear cloudy because of the oil. This cloudiness may be removed by rubbing with wood or denatured alcohol.

If a dull rubbed natural wood finish is desired, the piece should be sandpapered with No. 0 or 34 sandpaper, then rubbed down well with No. 0 steel wool (this will remove some of the variash but not the restored color), and waxed and rubbed as



Fig. 1 Applying clear varnish to a rubber made of cloth for use in a modified French polishing process.

If a highly polabed surface is desired, the polish is carried to a finish by sanding lightly with No. 00 sand-paper the first coat of oil and varnish, after the alcohol rub; then adding two or more

coats in the same manner, treating all coats alike except the last, which is given only the alcohol treatment and a thorough subbing with a good furniture polish or polishing oil.

The French polish does not change the color of the wood; it merely brings out the natural color and shows it to best advantage. In many instances, however, it is desired to make a walnut or mahogany piece darker (Continual on page 118).

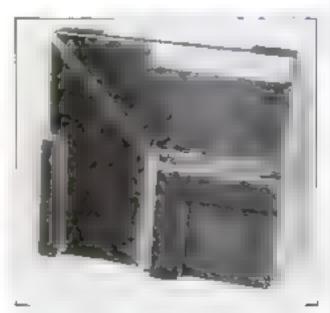


Fig. 3. A homemade wooden clamp for joining frames. It is shown in use on page 113.

2417

Oil Burner Improved with Baffle Plates

By George Fuller

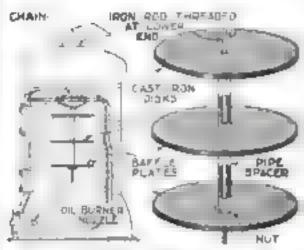


Diagram showing the buffly plates in place pack a larger view of the baffer themselves,

YEAR or more ago I had one of the A best oil burners installed in my home, After some use I real sed that the boiler, ake most home builers, could not almorb all the heat which the oil gave off in burning. A large part of the bot gases went capally up the stack.

The most promuing remedy seemed to he some system of baffle plates. Naturally, the sine of the baffic plates I could use was determined by the width of the turnace door. The heat was too much for thin steel, so I tried 36-in, pressed asbestos. While the disks in the upper part of the furnace stood up, those nearest the cames would crack after a short time b naily I used thin cast iron, which appears to be saturactory

I threaded a strong chain through the holes in the upper section of my furnace. and booked it together at the top, making a loop. Then I made a 12-in, rod threaded at one and and with a hook at the other end to engage the chain loop at the top of the furnace. Three disks about 15 in, in diameter were placed on the rod in the furnace and held apart by preces of pipe. The disks and spacers were held in place by a nut. Two disks, I discovered, gave almost as good results as three. It is best to keep the bottom disk at least 0 in, away from the flame level.

The baffle plates throw the hottest gases to the sides of the furnace, where the heat is absorbed by the water. In addition, I believe the gases swirt around more when they reach the upper sections.

This apparatus has been thoroughly tested and has been commended highly by one of the oil-hurner manufacturers; in fact, the company has suggested the installation of similar apparatus with necessary variations in at least fifty homes from New York to Florida.

With the same average temperature outside. I found that m the morning the steam showed at any particular radiator in from twenty to twenty-five percent less tune when the disks were used than when they were not used. As my furnace is new and fairly efficient, the apparatus might save more in some less modern plants. The annual saving in oil represents many t mes the small cost of metallation.

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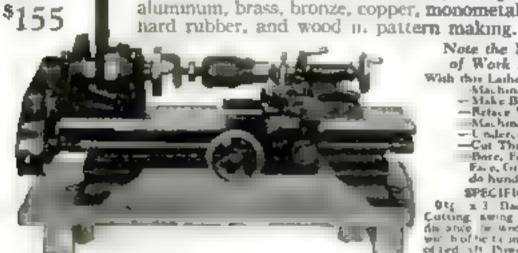
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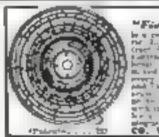
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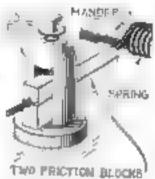


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Tool gest guide for winding spring wire.

the tool post. The upper and lower serteens have a V groove, from 1/4 to 1/4 in. deep, planed the cutire length. Any tension deared on the wire is obtained by tightening the tool post acrew.--H L.W.

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How the tool helder is made and wed.

pulot-ended set errew in one of them, and a shoulder planed for the tool is the other It would unually be used on the larger lather for forming heavy

course, should be binde na rugged an the tool post will allow -G A. L.

work, and, of

"This Helped in My Work"

Lordinard from page As.

held on the nuller arbor and grapped between a pair of cutters, a method fazi liar to toolmakers.-O. S. Mananatt.

NO PROTECT the spindle hole of small, or even large, lathe chucks, the handle shown in Fig. 4 will be found efficient. The writer has three in use. The handles, after being screwed into the chuck, can be placed through boles bored in a shelf, thereby holding each chuck III place, -FRANK N COARLEY.

THE quick-change punch and die houser I shown in Fig. 5 is one that I devised and have found after long tests to save time and stand up well under hard me.

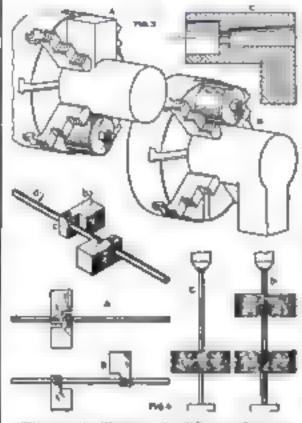
Let us look at the dis holder. Two drill rod pms project into the central hole as far as the depth of the groove in the die block. We drop the die block anto the holder and turn it uptil the pins are in line with the two slots. The die block drops down and the pins will come in line with groove; a half turn either way locks the block in place. Needless to say all parts must be a mee fit.

The punch works on exactly the same principle. An automatic dog or gage should be used on the press treadle so there will be no chance of the machine starting while the operator is changing

thes. ALBERT E. BIRD.

Mounting Lathe Work

(Cantinued from page 93)



Diagrams to illustrate the difference between static and dynamic balance is acting up work,

at rest while we intend to have it balanced while it is being spun, we are adjusting it to conditions which may not exist at all while it is being worked. The "real" or dynamic balance may be the same as static balance, but the chances are that they are not.

The main reason why the engine in your car runs without the vibration of the ancient chariot of ten or even five years ago is that the crank shaft of the new engine is dynamically balanced. It is true that the lathe spindle as a rule runs much more shady, but the unbalance as a rule is also enormously greater. As against fractional current in the crank shaft, there are often many pounds of unbalanced weight in the work in the lathe.

If you wish a practical demonstration of just what the difference in the two kinds of balancing means, you can make the experiment shown in Fig. 4—unless you are satisfied by merchy studying the drawings. All you need is a foot or so of stender rod, say drift rod, d, and two steel blocks b of equal shape and size, made as shown so they will dovetail over each other, and each litted with a set screw 0 so it can be held in any position along the rod o.

With the blocks placed opposite each other, whether in line as at A, or apart as at B, the rod and blocks will be practically at rut in any horizontal position. There will be no difference whatever between A and B. There is a very great difference in the behavior of the two actups, however, when the shaft is placed in the drill press, for instance, and the spindle started. Arranged as (Contound on page \$10)

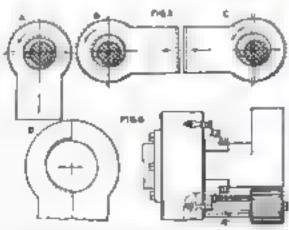


Figure 5 shows what happens when a set-up like B, Fig. 3, is used unstead of one like Fig. 6.

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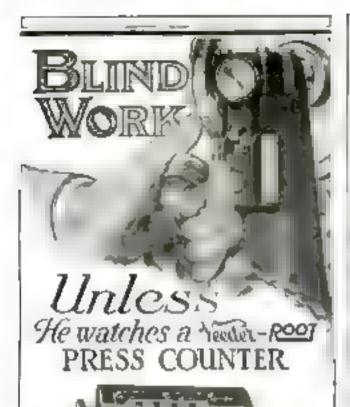
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mental work. If run backward the Price, \$2 00. counter subtracts. Cut 4/5 size.) Small Rotary Retchet. Counter, to register reciprocating movements of small machines, also \$2.00.

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Tool to Aid in Cleaning Machine Fixtures



Combination brush and scraper used for cleaning drill plates and machine fatheres.

DRILL plates and similar machine fixtures often accumulate hard spots of caked grease that cannot be removed with a brush.

One machinist made it a practice to keep a piece of tin handy for scriping the surfaces clean, finishing of with a brush, but the tin would be mislaid moner or later. He then conceived the idea of attaching a scraper to the brush, as shown above.

Quick Way to Space Holes

WHEN absolu accuracy is not essential, the met-od of marking off holes illustrated in the accompanying photo will be found quick and conven-

The work shown is a collar, which is to be marked for 6ve "tommy holes



How the collars were marked for drafting.

After chalking the beuch plate well. I described a circle slightly larger than the collar, divided it into five parts, and marked five turbal lines All I had to do then was to lay each count within the circle and pencil mark the five positions, after which I center punched the pieces reasy for drilling. - Anthron Kaprosett.

Mounting Your Lathe Work

Lasterne from man 100)

at 4, the red and blocks our reportily no matter how high the speni may be but with the blocks placed apart, a beavy subration sets in as soon as the spinitle begins to turn. This vibration increases with the speed until the end in visibly distorted two ways as at D

It will be understood now why the casting of Fig. 5 is basanced right at A, and wrong at H The fact that the casting is stiff does, of course, grake a difference, but it does not do away with the fact that the weight is wrongly distributed at B do long as the spandle is revolved morely, as when the lathe is run through the back gears in turning the large outside danneter, there is, indeed, basance, because the work is balanced for gravity. It is not, however, bal-anced for centrifugal force, so that when the spindle as driven at high speed in boring the internal diameter, the hole will be both oval and out of center as may be seen from Fig. 5, in addition to being tapering and at an angle to the faceplate, as at t in Fig 5.

A good way to balance the part in the second position by using the same weight is demonstrated in Fig. 6. A piece of large pipe, a. turned square at the ends, is used to block up the counterweight. The weight must be rigid. if accessary, it can be strapped to the casting to resist the centrifugal force tending to move it outward.

The third article in this series will appear in an early insite.





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How to Use Kalsomine

(Continued from page 78)

plaster; if it has some gloss, wash it down with hot water and a washing powder or sal soda to cut the surface a bit and then sinc it.

Old walls that are very dirty should be washed. before the apparention of histomise, or the ka.somine will loosen the dart, which wall be smeared around, making dark streaks in the finish. Sometimes it is easier and cheaper to apply a coat of fiat paint than to wash a very

Any hotes or cracks in the old walls should be cut out with the putty knule to remove luose euges. Undercut the edges so the filling we weather their in places. Wet the cracks or holes with water and fill with a patching planter or with ordinary plaster of Paris, smoothed over with a putty knafe or soft wood paddle. When dry, coat the fillings with shellac to stop suction.

VARIOUS since are mutable for kalcombae finishes, but glue size is most commonly used. It is made by making flake ming glue— say a pound—in a little cold water overnight. In the morning add one pail of bot water and stir the glue until dissolved, or work it with your fingers. If you are not sure that the glos is of a good strong grade, use a little less water. Some flor to add also about a pint of table vinegar to make the size penetrate better

Apply this she freely to the walls and ceilings with a kalsomine brush, taking care to catch up any runs or poddles in the corners. Let it dry at least overnight and longer if possible.

If a varnish size is wanted, make it by miring together equal parts, by volume, of firstclass floor varnish and turpentine. Then add a handful of fine pumicy stone to give it a tooth." Some Ske to add also a little flat paint to give color and thus help hale the surface to a limited extent

Prepared kalantaines are sold in five-pound and larger packages. On an average one pound. will cover about 100 square feet. Consequently, a five-pound package will cover with one coat an average room about ten by twelve feet with the usual eight-foot-six-meh cening height.

Follow the directions on the package in mining the knowming. They may call for hot water or for cold. Lukewarm water is better for the so-called cold water kaccommes. If the directions call for boiling water, be sure to have it. builing but, not just warm.

O'E of the first-class kalcommen is to be mixed in the proportion of four pints of boning water to five pounds of the dry kalsomme. The water goes into the pail first in all cases of dry pigment mixing, and the dry pigment is then powed a title at a time into the water while the mixture is stored well. Then, after dissolving, the kalsomine is allowed to stand until cold.

Such a marture will be about as thick to cream when first prepared. It should be strained through chresecloth while bot. When cool st will be thicker. It will "jell," as they say, and is ready to be brighted in that condition when the waits also are cold. In hot weather any kaleomine with a glue binder, if used in the cold jell condition, in apt to me my because of the heated condition of the walls. In order to avoid that trouble, it is best topuse the kalancine while it is still warm and before it has jelled.

When you want to mix two kaleogene colors together, it may be done while they are in the dry powder state or by mixing each color separately and then adding one to the other. heep in mind that you cannot tell what color kalsomine is until it has been applied and in dry. It looks darbor while wet then when dry. By mixing a little of the second color into the first, dipping a piece of cardboard in, and drying it over a stove or other source of heat, you can test the (Continued on page 1/3)

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How to Use Kalsomine

(Continued from page 111)

color. Strain the mixed kalsomine while warm. It is in the brushing that amaleurs are most likely to get into trouble with kalsomine. This is because they are likely to try to brush it out, to stretch it out, like oil paint. A good kalname brush of the standard type or of the Dutch type is necessary, and it must be dry when you start to use it. A wet brush is too soft and flabby to work well.

kulsumme should be flowed on freely and hrushed as little as possible. Flow it on evenly, keeping the brush well filled. Take up a brushful, apply it to about our square foot, and let it alone. Follow with another brushful and just up the second parter with the first with a light stroke or two, using the bristle tips. Then let it alone. Do not go back to the first putch.

Repeat this action until the surface is conted. Use semicircular strokes. Start at the upper left-hand top of the wall and carry a stretch down the wall about one yard wide. After reaching the bottom, return to the top and carry lown another stretch. Coat the ceiling first and use the same method

As a rule only one coat of kalaomine is apphed. A skalful brush hand can often "topover," as it is called, with a thinner second coat after the first as dry Sometimes it as occessary to apply a second coat of mac on top. of the first coat of knowmine before topping over. The trouble is that the application of a second coat is apt to left the first coat and reyeal the bare wall unless the correct brush action is used—thin balsomine and light strokes with the tip of the bresh Where good covering has not been gained, it usually is best to wash off the first cost and try again.

The finishing of walls with kelcomine in two- or three-tone effects is another story and will be discussed by Mr. Vanderwalker in an early imue.

Caustic Soda Found an Aid in Cluing Several Woods

STRONG glued joints can be obtained by treating with caustic node certain species of wear which otherwise frequently produce weak or inferior joints, according to experiments made by the Forest Products Laboratory of the I mited States Forest Service. Jointa of hard maple, yellow birch, whole oak, red oak, red grou, brack cherry, basswood, and onage orange wood treated with caustic soda showed decided improvement.

A ten percent solution of ensitie soda gave the best results. The wood surfaces to be joined were brushed with the solution and after ten minutes were wiped with a cloth to remove any excess. They were then allowed to dry before being glued.

in tests of hard maple glood with animal glue, the shearing strength (measure of the rapacity of wood to resist slipping of one part. upon another along the grain) of a piece of untreated wood gloed under favorable condi-tions was 3,110 pounds, as compared with 1.570 pounds for an untreated piece in which "starved joints were manifest, and 3,250 pounds for a piece treated with caustic soda solution, but glued under the same starvedyour conditions as gave a result of 1,570 pounds for the untreated wood.

Osage orange wood treated with caustic andaand glued with casein glue showed a shearing strength of over 3,000 pounds, as compared to a slienting strength of only 294 pounds established by the joints of untreated wood.

Just why treating certain who is with caustic. soda increases their joint streagth when gload is not known. Evidently the caustic side, changes the surfaces of the wood fibers in such a way. as to cause the aftie to stick more firmly

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Furniture Polishing Secrets

(Continued from page 10%)

to match other pieces with which it is to be used. This must be done with the first application of oil.

In using the penetrating wood dyes mentioned in the preceding article (brown makegany is best for walnut and dark mahogany for malingary, the other colors as recommended on the manufacturers labels, add enough of the required color to the lisueed oil, diluted as before, to give the wood the shade deared. Try it out on some unexposed part of the piece to be sure it is the right tone. Apply this colored oil as a first coat and the wood dye will dry in with the oil, superting a permanent color which will take a rub finish. Carry out the finish as before.

Boded lineed oil diluted with equal parts of turpenting is excellent for all wood except old curly maple, which it darkens too much. This is one wood on which gasoline or betune should be used, in the proportions of one part

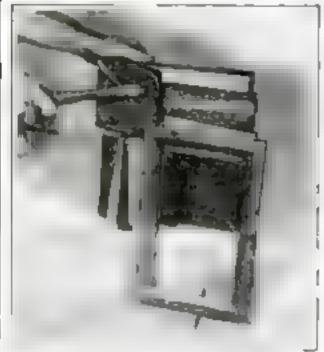


Fig. 4. Wedging up one joint of a small picture frome in a simply made wooden clamp.

linseed oil to three parts of the other. These liquids are highly inflammable.

A great number of antique pieces are found which have black spots and rings on their tops. Some world rather have these marks, while

others will not have them at all. If it is desired to remove them, proceed as suggested in previous articles as far as the first cont of oil, After this is dry, use a enhance scraper to scrape out the spots and enough of the surrounding surface so that the scraped places do not show as holes dug in the wood. Apply the diluted boiled oil frequently to the parts being accuped. After the spots are removed, apply the modified French polish described above to the places scraped, and finish as before

Cammet scrapers should be huznished. First ruly the edges on an nilstone anta they are square across and a trifle crowned or conves in the center. To burnish, use a nail set, regular burnisher, or other suitable tool. Figure 2 shows the proper position of the butmaker in relation to the scraper. Burnish with a linek-and-forth stroke.

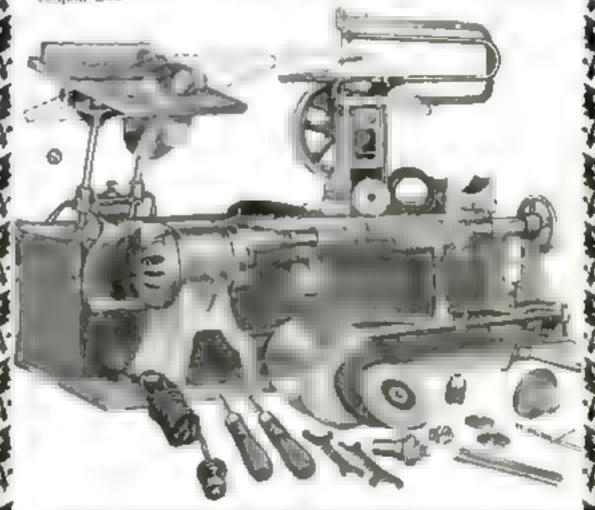
Various wooden clamps have been described. in previous articles. Figure 3 illustrates another. It is used to clamp up frames for nathing. The have in this sustance is 1/4 by 11 by 11 in. It is made to bold moletings up to 4 mehea in witth. How the same clamp is used to hole a small frame is shown in Fig. 4.

If, when the members of the frame are clamped up, the joints do not fit, a mw kerf may be taken from the joint on the diagonal.

Mr. Stunley's next and eighth article will deal with the repair of old chairs.



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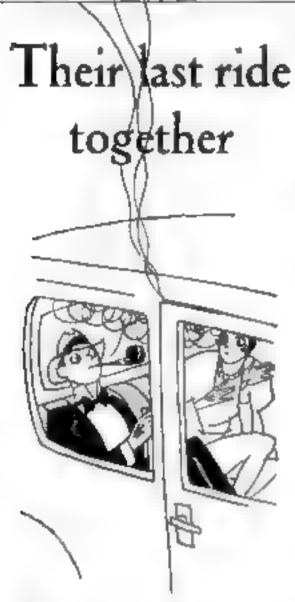
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Replacing a Broken Window Pane

Paste this Home Workshop Reference Sheet, including the head above, in your scrapbook in the section marked windows. (Jan., 1929, Port Lan SCIENCE MOSTRLY)

What are the stope in replacing a broken seindose paner

NOTITING of equal one can more effectively give an air of general dilapidation to a room or to the exterior of a bouse than a broken pane of glass. The difficulties of resetting a broken light, however, need not deter anyone from attempting it. An old chieck any 1 in, wide, and a putty kinde are the tools needed. The only materials required are the glass, glassers points, which are small triangular percess of tim or sine, and putty, all of which may be bought at any hardware store

I measure the use of the broken glass. I sually it will be of standard size and the space in which it fits it about by in larger early may to allow for ordinary variations in culting. We will not consider cutting the alass, for if it is not a stock size it will be cut at the hardware store when the putty and points are bought. If the pane is not a stock size, you will have to pay for the larger use from which it is cut if the glass is 20 in. on citier dimension, it is advisable to have it of double thickness.

it. When all tools and materials are at hand, take out the mak and remove the cords by methods described in a previous reference sheet (Nov., 1988). Take the such to an unused room if possible, but if you must work in a family room, spread newspapers liberally, for the old putty will fly as it is not out. Lay the each putty-side up on the table and with the chisel cut the putty away from the mah and the glass. If paint remover or hot mapy water is put on the putty and allowed to soak for five or ten minutes, the putty will be softened to some extent, but workshen seldon do that, for the same treatment will soften the paint of the such, which should not be disturbed. Remove the broken glass and cut out the putty bedding left in the side or bottom of the rabbet. Be careful that the wood of the mah is not cut or aplintered, or it will be hard to fittab the putty samostaly

A. To be sure the glam will fit properly, try it by laying it in the rabbet, bollow side down. Every piece of ordinary window glam is slightly curved and if laid with the hollow side up, may break when the points are driven. If the glass is a little large, has a projecting point, or is not exactly square and does not drop into its place easily, do not cut the torner of the mah, but cut into the wood near the bottom of the rabbet, as at Z in the illustration on page 100.

4. Be sure that the patts is an soft as it run be handled of too stocky, temper it by rolling it in whiteting or flour and work it in the hands. First "bed" the glass by rolling putty out into a thun sheet \(\frac{1}{2}\) in, thick or less, as in Fig. 1. A rolling pin or bottle can be used to do this. Holding the glass as shown, with the imade (are downwards, cut away an edge of the putty as at A to make a straight edge as at B. Place the edge of the (Continual to page 115)



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Repairing a Window

(Continued from Door . . . D

giam somewhat less than 34 in from the edge B and scrape off the putty as at C; do this all around the glass as indicated at D. Lay the glass into its rabbet, press lightly until the surplus putty between the glam and the rabbet is squeezed out as at A of Fig. 2 and Fig. 3. This must be done eautionaly or the glass

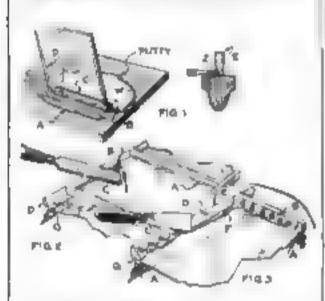
may be broken

5. Place glaziers points at at B, Fig. 2, and drave them with the chirel held as indicated until they project just enough to hald the glass and allow the putty to cover them when it is "run down." There should be at least two points on each side, and for a large alass they should be not more than 9 or 10 at, apart. Press the glass lightly as time is done and slole. the chisel over the glass as at C, otherwor a blow from the ctusel may break the glass

0. With the thumb, press putty into the angle between the glass and the mah as at B of Fig 3.

7. With a putty knife, "run down" the putty as at C of Fig. 8, making a smooth bevel, which will fill the corner as at D of Fig. 2 and Fig. 3. A little practice will cure the Brat awkwardness. If the putty knife is moistened in many water, it will slip over the putty smoothly. The curner of the man at E. Fig. il, will guide the knufe if it is held at the correct angle; if K is without splinters and straight, a true putty hevel should result. Care must be used, however, that the glass edge of the putty at F does not project beyond the such ralibet at G, or it will be seen through the glass from the inside. It is excellent practice to keep the putty edge a little back from edge of the mah rabbet

8 Tuen the such over and with the putty knife remove the waste bedding putty if if



A thin strip of putty is placed on the inner edges of the glees as in Fig. 3, the glass is said. in the rubbet and held with giariers points in in Fig. 2, the party is applied as in Fig. 3.

Figs. 2 and 3. A little whiting or flour dusted on the putty bevel will stiffen the surface and nelp it to harden.

Clean evidences of putty from both sides. of the glass with a soft cluth, being careful not to deface the putty bevel.

20. Rehang the such and put the stop strips

th place.

If The color of the new putty will probably be different from the rest of the mah, thus telling all observers that a new light of glass has been set. After several days, in which the putty will become sufficiently bard, it may be painted.

The glass of outside doors may be set with putty, but often the glass of anside doors is set with beaded strips of wood nailed in place. These strips must be removed, the new glass put in without points, and the straps nailed in prace. Glass in a door usually can be reset without removing the door from its hanges.



Smoking Table

Seels Proge a Book



Lady Washington See La Page a Blank, page 7

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Clothes Drier Built Over Stairs

By DAVID O. WOODBURY

THE problem of drying the family washing during rainy days and in winter, when everything wet freezes the minute it is put on the line, often causes the housewife much annoyance. Particularly is her problem a difficult one when there are several small children for whom daily washing must be done.

The usual solution is to hang the washing on a clothrahorse indoors or on a line in the cellar or attse, but neither way is ideal. In casting about for some way to dispose of a large daily wash in a small single-family house, I hunted at conarderable length for a place that would be out of the way, would allow the clothes to dry quickly, and would be beyond the reach of mischievous little hands. Finally I found such a place in the stair well. It is subject to a strong updruft of warm air in winter; it is perfectly clean, it is out of reach of the children, and it is out of the way and practically out of night. As the space above the stairs usually extends to the ceiling of the second floor, there is ample bright to hang the clother where they will not touch the head of anyone going upstairs. Incidentally, the drier

It is only necessary to find something to hang the clothes on. This may be done somewhat as undicated in the accompanying sketch. Two speight pieces of wood are fastened to the banusters of the stair. rail on the second floor. Across these pieces and fastened to the top of them is a horizontal rod with notches 14 in, deep and 3) in, wide out at 6-in, intervals in its upper edge. A similarly notched piece in screwed to the stair well wall opposite the first piece and on a level with it

acts as an efficient humodifier.

Next a set of crosspieces is cut from suntable lumber as shown and well smoothed with plane and sandpaper. Three strips should be about 34 in. square in cross section and 4 in, longer



Nach for drying clothen placed over stairs to take advantage of updraft of warm sit

than the distance between the two beeisontal pieces already mounted, they form the "line." Even when out of service, the strips are kept in position.

One wooden strip at a time is removed and the clothes hung over it while I is held in the hand. There is but one cantion to be observed-to get the washing well wrung out before it is hung up.

If properly constructed so as to be ngid, the device will work remarkably well. On the average, a small piece of clothing will dry completely in half an bour in winter. The fact that the rising air as clean leaves the clothes unmarked.

The drive I built for myself has eight crossbars 4 ft. long, equivalent to 37 ft. of elothealine. Constructed of scrap lumber, at cost possibly fifty cents and look two hours to install

Improving an Automatic Gas Range Lighter

FTER an automatic gas range lighter A has been in use for a while, it sometimes will cause almost unbearable fumes and make the bottoms of pots and pans sooty. Soon it becomes difficult to main-



By cutting a hole in the lighter cap, the formation of carbon in prevented.

tain a flame in the little pilot light. All of these troubles are due to the formation of carbon in the combustion chamber.

The remedy is easy. Simply cut a %in, hole in the top of the lighter cap. This hole provides a pressure release when the

button is pressed and prever to the flame. from coming in cortact with the metal parts of the cap. Soot and fumes are ent rely el manated

If when the push button is pressed, the pilot light is blown out or a maring sound is heard, too much gas is loong used. This could have can be corrected by nursus of a because adjusting nut to be found under the button. The a wrench to serew the nutcloser to the button.

There is also a screw on the side of the fitting near the button to adjust the beight of the permanent flame, which should be about 14 us. long under ordi-Bary circumstances—JURN H SCHALER.

A nuranus quick drying putty is made by thoroughly mixing Spanish whiting in orange sheliac until the mass is about the consistency of ordinary putty. I use this putty exclusively in pattern making. It dries hard and appears to have very little shrukage.—W. O. ASCHERMANN.

Setting Up a Model Railway

(Continued from page 77)

result in irregularity and uncertainty of opera-

Take pains to see that straight stretches are really straight and that they will stay that way. This means that each section should be lastened to the floor or bench with screws. One screw close to each joint will do. Don't use nade. You will have trumble pulling them if you desire to make any changes.

Track can be laid straight by stretching a string an such or two shove the floor or benulaand then measuring from the string to the bearest rais. This is a much better method than to rely on aghting along the rails.

Banking the curves at the ends of long straight airriches will bein to prevent denulments. black the banking on the straight section before the curve "small pieces of wood under the outer ends of the ten was give saf-

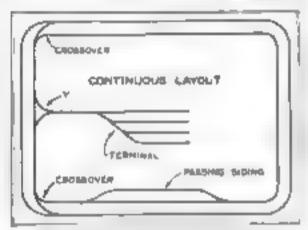


Fig. 5. This type of track layout allows trains to be run as in actual practice.

ficient bank and the screws that clamp the track will hold them in place. A banked curve is shown in Fig. 1. This curve is banked about five degrees from the horsontal.

Avoid 8-curves made by connecting two curved sections together. If you must have an S, insert at least three quarters of a straight section between the curves.

TRACK layout that includes grades for the A locamotive to climb will prove more interesting than a layout where all the track is on the level.

Do not make the grades too steep. The slightest amount of oil on the track will enuse the locomotive driving wheels to slip, and the train will stall if the grade is too heavy iteal railroads rarely use a grade steeper than one in thirty, which means that the train climbs up one foot for each thirty feet of track. Any well-built model electric jocomotive will climb such a grade and pull the must number of cars without under wheel slippage The heavier double-motor locumotives will start a full train from a standshill on such a grade. Figure 2 shows a trata climbing a gravie of one in thirty

Space limitations and the arrangement of your track inyout may, of course, necessitate a steeper grade. This is permissible if the grade is short and there is a straight run at the bottom of the grade so that the locomotive can get a running start. Another way out of such difficulty is to make the grade quite steep near the bottom where the momentum of the becomative will help to carry it up. The upper and of the grade (Continued on Supp 114)

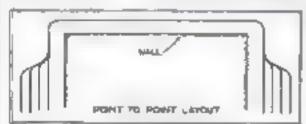
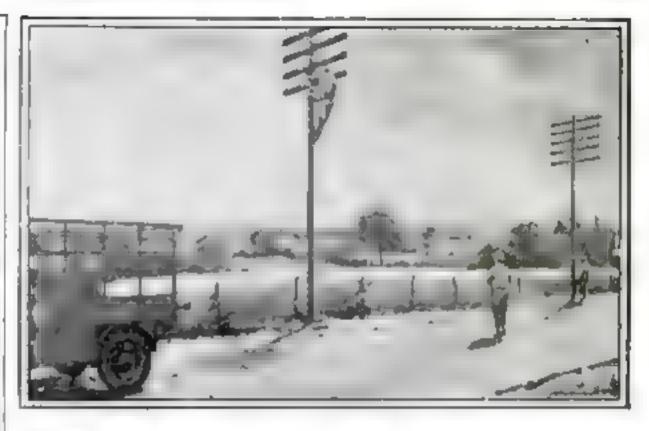


Fig. 6. A good arrangement when trains are to be run through a hall between two anial cooms or in very narrow quarters.



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An Advertisement of the American Telephone and Telegraph Company

IN THE gold rush year of '49 a stagecoach succeeded in erossing the continent in about three months. Two

decades later, for the first time, an unbroken stretch of railroad lay from New York Harbor to Sun Francisco Bay, and America was seven days wide. Today, by telephone, that entire width is only a matter of minutes. And these few minutes represent & round trip, taken in the case of office or DOP 6

The Bell System is ever busy reducing the width of America and the distance between cities. For example, during 1929 it will add to its lines nearly 2,000,000 of the new permuliar loading coils for correcting and maintaining the speeding voice gurrents.

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high, have been made in telephone central office equipment.

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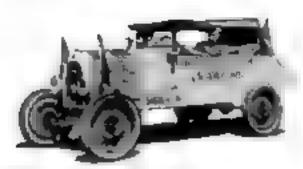
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Setting Up a Model Railway

(Continued from page 117)

should then be made a more gradual climb-One of the simplest ways to metal a grade is to take a single board the length of the grade and cut some short pieces, beginning with a I in piece, then a fin piece a *in piece. and so on. These can be placed at uniform intervals under the long board and the spacing between them will determine the grade. For a one-is thirty grade for example, the graduated supporting pieces should be thirty suches apart. If the laund in which the track is fastened is 5 or 0 in. wide and 36 in. thick, the supports may be as much as thirty inches apart, but if a thinner board is used it will be well to double the number of supports by cutling them in 1/2-in. steps.

YOU may not be so fortunate as to be able to put your track down permanently. However, it is possible to make a minimatory portable track layout, although of necessity it cannot be made as elaborate as a permanent contable too.

Obtain from the nearest lumber dealer several sheets of ply wood. The three-ply sheets a fraction of an inch less than \(^1_1\) in thick will do. Instead of fastening the track to the floor of a permanent bench, cut lengths of ply wood to fit under the track. This will permit you to take up the track in long actions without danger of bending it. As p ywood is limited in length, timally the maximum length of a single strip cannot be over 3 ft.

The terminal can be mounted on a single piece cut to the proper size. By carefully planning the breaks between sections, you will be able to build a track layout that can be taken up in sections and stored in a convenient closet in just a few manutes.

PORTABLE grades can be made just like permanent grades except that the plywood is used meteod of a thick board and the supports will have to be attached to the track board by means of cheap iron hinges to adverthe supports to be folded against the track board when you wish to store it.

Real locomotives with strings of passenger or freight care behind them go by with a tremendous roat, so that the some of a model train as it gues around the track is quite natural and realistic. However, the people living in the ruoms directly under the floor where the model railway is installed may object to the noise. A permanent installation cannot be muffled to any noticeable extent of the track e fusience directly to the floor. Putting strips of felt under the track will not do much good because the vibrations still will be transmitted to the floor boards by way of its screws. The only practical solution is to mount all the track on boards just as though you introded to make it portable and then give strips of felt under the boards. The felt will prevent any direct vibrations from being transmitted to the floor

In a account article schoduled for publication in the February issue, Mr. Ryder will tell how to plan a control system for a model railway.

Wages a tile in the bathroom or ketchen wall becomes loose, cracked, or broken, the handy man often wester that he could make the per-tuary repairs howelf. Excellent cements are used for streamy loose tiles in place and the tiles themselves can be purchased. The main difficulty has in cutting the tiles, if that is necessary, which often it is. No home worker is upt to have tile enting sippers, but he can cut the tiles by scoring the glassed safe with a glass cutter and then using places with parallel part to because off the part to be removed. A tile can even be cut cleanly in half by using the glass cutter on the face and then tapping the underside along the same line. S. T. D.



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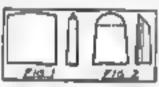
(Continued from 1990 78)

the piece were actually forged down from a thicker piece.

Large work should be placed between the vise jaws for filing down the cut edges, but between the paws and the work should be placed some thick cardboard, copper, or even tin to prevent the jaws from marring the work. Do not forget that common chalk rubbed on a file will prevent copper sticking in the teeth to a large extent,

Small work and the cut-out spaces in the interior of large work may sometimes be filed to advantage by placing the asstal flat on the bench put where mwing is done and then filing it with an up-and-down motion. Coarse and fine emery cloth may be turn into narrow strips and, while the work is held in the vise Jawa pulled book and forth.

In making a key plate (Fig. 8), form the keyhole by first drilling a hole to take the

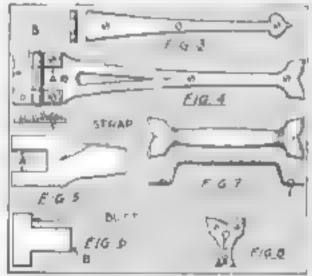


Cold chine and special chasel for surved cuts.

shank of the key and) two moniter boles at the bottom of what is to be the slot bylow. Then use the cold chimi to cut out the metal between the boles. Holes are, of course, drilled

for the holding screws or escutcheon pine. File the rough edges up Beatly, imang your template as a guide, and then chamfer or round all edges. Of course, you may saw out such small pieces as key plates and small hinges, but for large work the cold closel is much quicker and easier. Bawing will be enplained in a following article.)

Sometimes, to avoid making a hinge joint, an instation hunge is made by cutting out a separate arm or strap, so that it may be screwed next to a common butt hinge of brass or steel and appear as part of it. One such is shown in Fig. 5. The butt hings used with



Hinge strap, complete hinge, petters for cutting the hinge lugs, and handle and key plate.

this is usually electroplated and colored to match the finish on the strap, as are the screws or nails used to fasten the hinge. (Simple methods of electropisting copper, miver, and gold will be explained later on in this series.)

To make a regular hinge joint, like those used on commercial butt hinges, is a Job beyond most beginners. There are other ways, however, to make a hinge joint rather simply Such a joint and hinge are shown in Fig. 4.

When a large is made of soft metal, the pin on which the hinge turns should be larger than it would be if the hinge were made of a harder metal, such as hard brass or steel. The hinge shown is 91, in long, and the pin used for it is about 50 in thick, of Bessemer steel rod, but the shank of a large wire nail would have served. The log B, Figs. 4 and 6, is planned so that it may be bent around the pin. and lapped flat downst the butt plate, as are the lugs (Conhessed on page 140)

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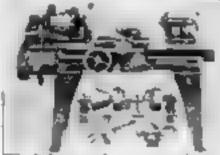
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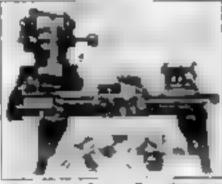
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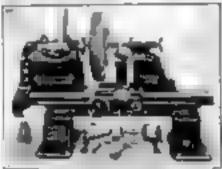
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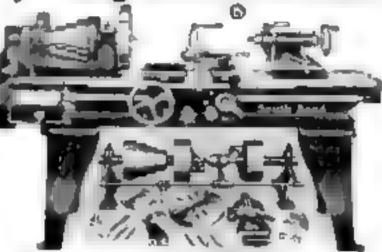
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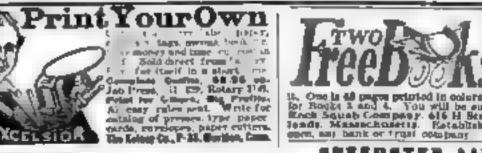
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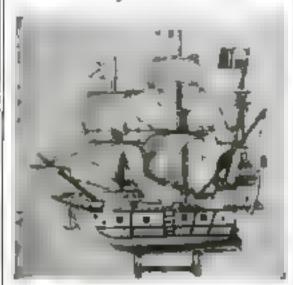
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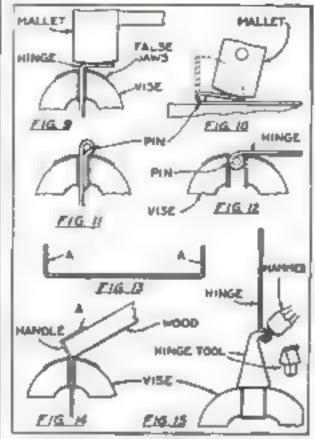
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Artistic Hinges

(f. out, word from prep 1.18).



Expe in broding and forming hinge joints and making handles, and a special hinge tool.

I on the strap of the honge. These lags are actually held down by the screws which secure the hange to the woodwork.

When the kinge is cut out, the hinge of the strap should be like Fig. 8, and the butt is made like Fig. 6 if it is to be mounted at right angles to the hinge strap. Prequently hinges are made where the butt plate is to be set flat, showing the whole shape of it. In this case the butt end is made larger and of a design to match the rest of the hinge. The butt end of the hinge above in the lower left-hand illustration on page 79 c really made to be let into the woodwork at right angles to the large, but has been photographed flat in order to illustrate the construction.

Figure 9 shows how each lug is heat over at right angles. You will have to determine the position of the bried for yourself; the thickness of the pin and the thickness of the metal used will govern the position of it on the lugs.

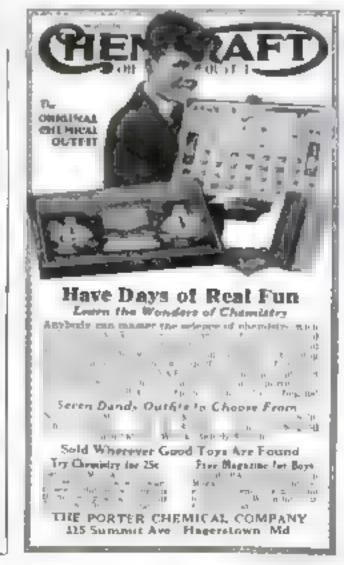
The labe vive paws shown are made of No. 20 copper. A flat piece of copper as long as the spe jaws are wide, and wide enough to form a jaw is placed between the jaws of the vive and harmored down to fit. Another piece of copper of the same size is then placed in the vine—the first labe jaw remaining in place—and is hammered down. All sharp edges on both pieces should be well rounded over. You will find many uses for these jaws, as they prevent the rough scoring of the vise jaws from marring your work. Common sheet to from a to can may be used for this purpose and for filing labe jaws made of card-board are often used.

When the angles are formed in the lugs, place the work flat on the anvil surface, by the pin in the angle, and hammer down the ling or lugs as in Fig. 10. A wooden madet should be used. Next the work is placed between the vise pass as shown in Fig. 11 and the vise aqueesed up tight. During these forming operations it is well to have the pin 8 or 3 in lunger than it is to be finally.

When the hange joint is formed, the pin is put in temporarily to see if the joint turns freely and any excess metal is filed off.

When you are ready to place the pin in the hinge to stay, saw the pin off so that it projects about to us beyond each end of the barrel. Rest one end of it on an anvil and use a built peen hammer to (Continued on page 121).





Artistic Hinges

(Confinent from said 1st ,

rivet over the ends, riveting each a little at a time. Test the hinge joint as you rivet the pin, to see that it turns freely and that you do

not bow the barrel out of line.

If you have had some experience in metalworking and with to make a regular hange joint, you may proceed as described, but the excess metal of the lugs may be sawn off with a back now and the joint completed between the vice jaws as in Fig. 12. This takes some mee planning as to how much metal to leave; it is difficult to make a next job. A bange joint of this kind, if made of soft copper or brain, is usually silver soldered for strength on large hinges. Silver soldering will be described later on in this series.

PROFESSIONAL metal workers sometimes use a hinge tool forged from an anvil bardy as shown in Fig. 15. The bag or lugs to form the barrel of the hinge are first bent up at right angles; then the hinge is placed on the tool as shown and the joint hammered into shape. The joint made in the hinge shown in the central flustration at the bottom of page 70 was made in this way, but, frankly, it is a difficult operation

Frequently small hinges for boxes and the like are made by soldering lengths of tuhing to the two fint parts of the hange and mwing and filing out alternate sections to form a hange joint. Such work is usually silver sol-

dered for strength.

When the handle, Fig. 7, is cut out and filed up, the flat metal may be bent into a handle form by first bending up the two ends, as at A in Fig. 15. The bancie is then completed by placing each end in a vise thig 14 and using a stick of wood and a hazamer to drive down the metal to form the second bend. Wooden tools are often used in this way. The screw holes are assumbly strated after the parts are formed into shape.

N ATTHACTIVE firesh was obtained on A the hange, handle, and key plate shown comply by heating the metal with a blowtorch to a grayish brown, then rubbing away parts of this finish with a ray charged with dry pumice powder, after which the work was lacquered with a clear lacquer. The colored lacquers used for home decoration may be used to firm metal, but thinner should be added to make them less dense in color, so that when they are brushed on the work, the pogment will settle in the hollow places. Even common house pa at, particularly green, may be applied to copper or brass, parts of it being wiped away with a nest rag while wet.

For brain and steel work, brain or steel screws may be easily obtained, but for copperthe screws usually have to be plated to match. the copper. A oramon round, or that bend wood. acrews of steel may be given a light coppercoating by placing them in some old pickang mistion—say nine tenths water and one lenth. sulphuric acid- in which copper has been frequently pickled. The steel screws should be bright and clean. Beass screws may be given a aght cost of copper by tying Iron wire around them and placing them in the pickle.

Steel screws so treated should be washed in clear water, dried, and then lacquered immediately to prevent the steel resting through the copper. Steel or bruss acrews so plated may not be colored with fiver of sulpbur, an this will eat off the thus coating; if they are to be enlored to match a dark copper, it is best to touch them up with a dark colored oil paint,

The next article—on sawing—is scheduled for early publication. When compiete, the series, which began in the November, 1927, insue, will constitute a complete course in art metal work.

The first of the second of the



A definite program for getting ahead financially will be found on

page four of this issue

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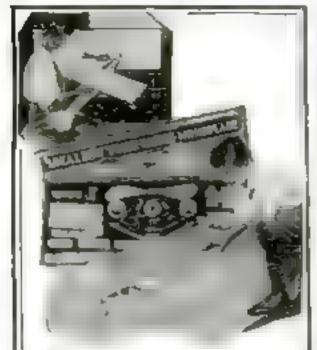


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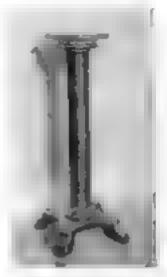
How to Turn Large Columns

By GEORGE H. WHITEAKER

OF THE conventional plans published for pedestals, jardimere stands, and sundar turned pieces, very few are available for use in the average home shop because the columns are glued up in air or eight pieces. Many amaleurs do not

have the patience or equipment to make the necessary long hexagonal or octagonal

The job may be dure by gluing one board upon another until the desered the kness is obtained, but the piece will be very beavy, there is considerable waste, and the last point on exther side, being at a very mush made to the turned sur-



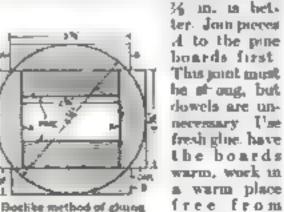
Oceanship predestal any turger can make.

face, in likely to show rather plainly A surproungly large circle can be turned from \$2 or boards glued up boxwise. The corners will be rather thin when turned, but they can be strengthened by including a core of cheaper and lighter lumber. This is best done by gluing in two pine boards as shown in the drawing below. A column made in this way proved to be stronger than a hexagon column, it is a great deal easier to make, and the joints will be invisible of the work in well done.

It is wise to select quarter-sawed or edge-grain boards for this job, especially if oak is used. Plat gram material is very likely to splinter while being turned.

Plane the edges of two pieces of pine exactly 214 by 30 in. The dimensions must be exact and the edges straight and square. Do not plane the sides yet.

Pieces A are cut from hardwood to the same length. Leave them a little oversine, and be sure that they are full ¼ in thick,



up a column for turning,

apply plenty of clamps, but do not pull any of them tight enough to warp the boards. Lastly, be

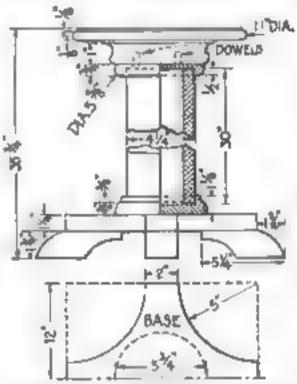
drafts, and

sure the job is square. Let the glue set for twenty-four hours. Then smooth the pine sides. Pay extra attention to the oak edges; that is the part that will show your workmanship. It is a good idea to have the middles a hair's breadth low, to make sure of contact on the edges

Plane the inner sides of pieces B with a smoothing or block plane just enough to : remove the high lights left by the planing mill. Have the plane very sharp, set it just deep enough to touch the work, and stop as soon as the surface is smooth. Cut a greeve 14 in, square down the middle and one % in from each edge of pieces B to take the surplus glue. See that they are correctly centered when assembling. Note that these pieces should be full 5% in. wide, but not more

FTER the glue has set for forty-eight. A hours or more, plug the openings with a piece of scrap. Find the center of each and, check the location with a compass, and drill a small hole in each. Seat the lathe centers firm y and turn at slow speed. Such a piece will develop a tremendous centrifugal force if turned fast and may blow up.

There is ample opportunity for the expression of individuality in the design of the top and base for this piece. In any



Working drawings of the turned pedestal shows in the photograph reproduced above

case, each end must begin with a collar. The one at the bottom is best made of 14_k in material.

In building up the top, glue a piece of paper between the collar and the next board. Mount the piece on a large (accplate and turn out the desired design. Turn the collar to a depth of 1/4 in. and fit snugly to the end of the column. Drill holes for two short dowels and then take apart by splitting the paper. Fasten the color to the column with screws and glue, then attach the rest of the top, using the dowels for guides.

The base may be made in the same way or band sawed to the design illustrated.

Begin the finishing process by sunding with the grain until all rings are removed. Stain, fill, shellac, and varnish as usual.

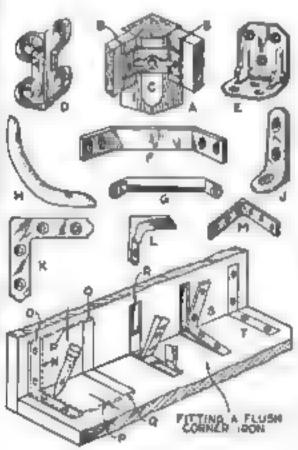
Hints on Applying Corner Braces

By DAVID WEBSTER

MANY products of home industry would last longer and be more worthy of their makers' pride if a few corner braces were fitted at strategic points in their anatomy. The accompanying illustration, which shows a few types of the common braces found in almost every large hardware store, should surgest their value to the burne worker, and the obvious case with which they may be installed should encourage their use.

Brace A in designed especially for building tables, atools, piano benches, and the like. Dowels are used in the joints between the rails and the legs merely to hold them in place while being assembled. Slots are cut as at B, and the back of the leg is cut away as indicated at C.

Braces D and E may be used for tables, cabinets, and other pieces where they may



Standard types of corner braces, and steps in cetting me angle iron flush with the wood.

be placed out of night under the top of shelves. Braces F and G will give excellent service upon chairs, heavy bookcases, and cuphoards, where they can be effectively placed, for they are designed to reast racking strains.

Brace H is of bent wood, usually oak or uple, and is suitable for reinforcing chairs. It may be placed wherever it will function as part of the design,

At I is shown a very strong, rigid brace; two of these at the back of each end of each table rail where it joins the leg will maure atability. Often they are placed where a large iron could not be used but where strength is required.

The brass braces K and L are well finished for use upon work where they will be in eight. Black .rons similar to K are often placed out of night for bracing and holding corners, usually (Continued on page 124,



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An inch or so of water is placed in the pail and the duk fitted above it. The upper part of the pail is filled with mash. The heater is then placed on a stove and the water brought to a boil.-E. R. SMITH.

Applying Corner Braces

(Centinued from page 188)

being sunk flush with the surface, while L is placed with due regard for both strength and appearance.

The corner from M is a common type, which may be sprung to fit various angles. Often it is simply laid on the wood and the screws draven home, but it is better to sink it flush with the wood. He sure the edges of the iron are filed square if they are rounding, otherwise they will not fit well. Lay the iron in position as shown by the dotted lines at N and mark both aides of the corner deeply and accurately with a sharp knife point. Set back from ends O the thickness of the iron as at P; mark the ends as at Q, and cut the slot with a cheel as at R. Place the iron in the slot as at S and drave the acrews. If the slot is too deep, build up with cardboard to be sure the face of the iron will be flush with the wood as at T

Many discarded pieces of furniture may be restored to service by using braces.





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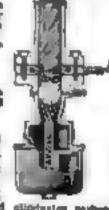
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Fighting Skipper of Air

(Continued from page 5d)

often our language proved a bit too much for him and be slipped back into his native tongue.

"Well, you know," he began, "that the weather over the Atlantic in the last few weeks had been very bad. So I had to make a special kind of trip. I could not go right out straight across the Atlantic, and yet I felt I must go, once out ship was completed

He took a couple of pulls at his cigar and

went on-

"I was bold. I was bold enough to say that the weather would out keep me from starting out as soun as the ship was finished. That put zoo in the position of either heing a line or making the trans-Atlantic voyage. So go we did. But because of the neather over the ocean, we had to go by way of Spain and Gibraltar, and that added 1,000 statute miles to the journey! From Gibraltae by the way we come, near the Asores, it was a little more than 5,000 miles to our destination in America."

WANTED to know the details of the accident that tore the fabric from the lower side of the port fin, in the repair of which four members of the crew, led by Dr. Eckener's own. twenty-four-year-old son, Knut, covered themserves with glory. It was evident that the Commodere did not deem this occurrence worthy of much mention.

The storm Dr. Eckener called "a squall," and to the mishap which brought a message to the United States Navy to stand by with rescue ships be referred as "a little accident."

"Well," he said, "we were struck by wand as we went along amouthly at seventy-five unlesan hour, with every motor turning perfectly

There was a sudden increase in the wind and run came with it is real aquall. The Grof Reppeles shot upware to an angle of forty de-grees or so. The young believes on duty tred to bring her back to a horizontal plane, and in doing this he put a midden strain on the stabil ser and that burst the fabric

"The stuff enoght in the wind. It was suppost away for nomething like a hundred square yearls. Of course, it had to be repaired at once

or more of the covering would go.
"It was a little accident." Dr. Eckener continued. "It never happened before in the history of Zeppelins and it can never happen again! Naturally, we were handscapped by it. It happened at eight o'clock in the morning and the trouble was fixed at one o clock in the afternoon. In those five hours, we stoud almost entirely still. And even after the repairs had been made we could only proceed at half

HERE I talestupted.

"Tell about the repair job! Wasn't your son one of the riggers who went up to fix jt? I makeel.

The Commodore's face glowed with unmistakable parental price and pleasure. "All right, then," he united, "all right

But this was a rather personal matter, and

the English words refused to come easily. Bohe told me in the most pulished German how Knut and the three others had repaired the

As he talked. I now an intensely dramatic picture of four young fellows running up the cat-walk into the tail of the ship, scampering up the girders of the frame that meets the finat that point, and then, one by one, armed with shears and knows, more pygmies in comparison with the monster whose wound they set out to hind up, climbing out over the ocean on the spars that make up the frame of the fin, clear out thirty feet along the duralumin beam, with nothing between them and the maring, storm-swept Atlantic but 1,500 feet of air!

Clinging desperately to their periloss perch, beaten by storm and rain, towed up or down. fifty or a hundred (Continued on page 146)



Must Men Suffer after 40?

A WPILL-KNOWN secentiatis new book about old age revenue facts which to man men will be accusting. Old similaries that the the de of all times past this bill age are used to have a certain seld to prestanted the older? The year known the frequent cause of this decine in vitality

Common "Old Age" Symptoms Mindred men hower this resolution he is per and and the principal planed. Science is a require that is purificating parallel not cold not cold categories that the better that the blander and is desired that the first parallel is a state of the composition of an array. We are allowed to represent the purpose of the property of the composition of the comp tie, ervere bindder inflammation.

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A sellte program for getting ahead financially will be found on page four of this issue

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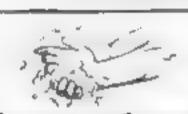
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Fighting Skipper of Air

(Continued from page 196)

feet and climbung back and forth as the tail of the Zeppelin swong on the fickle wings of the wind, they succeeded in cutting away the hanging shreds. They never stopped for a moment until the job was finished fully five hours with no let-up in the storm.

But Captain Flemming, who was at the coetros in that smil-trying bour, told me a slightly

different tale

knut was the first to volunteer. When he and the three others but crawled way back to the damaged fin and the Gref was practically standing still Hemming turned to the Commudore and said

We must start two engines."

Dr. Lekener knew that if he ordered the motors started the wind might test has son, and perhaps the others, too, off that precamous place and hurl them to the waves below. But the stern of the thip was beginning to say under the delage of min, and so he also know that he must move to try to moneuver out of the

"I MUST have two motors, Flemming re-

The Commudate's face suddenly grew very ald. He looked out of the window in his favorite corner of the bridge. He swallowed hand There was no telephone communication between the bridge and the fin, where knut however between clouds and water. Then he and husids

"last the molors"

What Dr Eckener west through from that minute until his son climbed down to the cobtrol room five hours later to report that the repairs had been made, only he and Heaven

"Were the pussengers (rightened?" I asked

Dr. bekener

To tell you the truth," was his reply, this time again in English, "I was so busy on the bridge that I hadn't time to go into the passenger-cabin to find out how the passengers felt.

" I did so as soon as we were under way once more. I found them calm, and renouved them as to the rest of our trip. Then we got out a bottle of race were and had a little toast and we al felt happy again.

But a semewhat different version of what happened right after the fin had been fixed was given me later by one of the passengers.

"YOU know," and this man, "Dr Eckener bad a pet canary abourd whose toubl function it was to sing to him and to act as a gas-detector. The Commodure seemed unit qually attached to the hink Now, the moment knut had come down and reported that the stabilizer was all right again. Dr. Ecketter left the control cabin and went aft to look after his carmry. He found the bird in high spurits, staging away at the top of his voice, and he calmly fed him. As a matter of fact, we pursengers had been greatly upset, but when we heard about this, our fears were put to rest.

As Dr. Eckener was finishing his story of the voyage is the flight office, somebody handed him a slip of paper. It was a racing ram, but as was peneded hastily in English, he handed it to one of the hystandres for translation.

It proved to be a message from Dr. Eckeser s

"She sends love and congratulations on your borthday, said the interpreter

It then developed that the radiogram had here delayed for some reason and that the buturday when the "nitle accident" in mid-ocean occurred had been Dr. Eckeber & surlyfifth birthday!

Dr Eckeurt told me of his views regarding the roture of trans-Atlantic dirigible transportagion and of the lessons his recent expersecce tanght him. (Continued on Page 197)



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Fighting Skipper of Air

(Continued from page 146)

He predicted the establishment of a regular airship service between the Lasted States and Germany in three or four years, with a dirigible leaving from each side of the Atlantic every five days and making the crossing in between forty-five and fifty bours!

But to make such a service possible, be said, a capital of \$14,000,000 will have to be raised for the building of four Zeppelins—two in this country and two in Germany-and the construction of two hangars, each large enough to harbor two of the guant ships at one time. Of the required sum of \$14,000,000, the building of the dirigibles would take \$8,000,000, and the balance of \$6,000,000 would be necessary to erect the hangara,

THE Commodore then strewed the factmany later that his voyage in the Oraf Zepprise has shown built that specifier ships will be required for regular transocranic traffic

"The airship of the future," he told me, "will only be slightly larger than the Genf Zeppetin, but it will be more swift. It will develop an average speed of eighty or eightyfive miles an bour, preferably eighty five. It will earry but few passengers and will be chiefly used for carrying mail and merchandise.

Dr. Eckener also admitted that the trip had taught him that stronger labric must be used

for the stabilising fine and the tail.

The Commodore's forecast regarding the creation of a regular Zeppelin service, though perhaps not quite so sauguine, was in line with cuthusiastic views he expressed a little more than a year ago, when he made his last previous visit to the United States. At that time he came and went by steamer and remained in this country only a short while to complete some business arrangements.

Then he visuamed a dirigible trip around the world in twelve days—a dream that may well have caused the late Monsieur Jules Verne

to turn in his grave!

Although his short sojourn in the United States in 1987 was little known publicly, Dr. Eckener is by no means a stranger to America and Americana.

When, in October 1984, the time came for the delivery flight of the ZR-J, now the Los Angeles, to the United States, Commodore bekener himself took the controls and acted as commander of the ship on the voyage from the hangar at Friedrichshafen to the Naval hanger at Lakehurst. This was the longest nonstop trip ever made by aircraft up to that

UPON his arrival here, the Commodore won instant popularity, and on his return to his native land, he found biniself received with all the enthusuatic booor and accious usually reserved for a troumphant war lord. He was repeatedly mentioned for the German ambasandorship to the United States and even for the Presidency of the German Republic But be amingly though steadfastly declined these high distinctions.

My life," he said, "is hound up in the building of airships. I am not a diplomat nor a

ըսկելար.

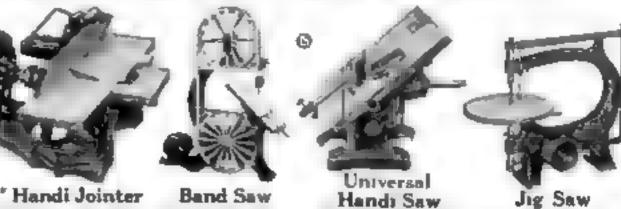
And he was right. At least, the last twentyright years of the Commodore's remarkable career have been devoted to the development. of the drigible as a means of safe and swift

transportation.

It was in 1900 that the meeting took place that proved the turning point in Dr. Eckener's life. On the shores of Lake Constance, near the Bwos-German border, where he had deerded to settle down as a writer and publicust on subjects related to economics, his specialty upto that time, the Commodore became acquanted with Count Ferdinand von Zeppelin, saventur of the dir-(Contenued on page 146).

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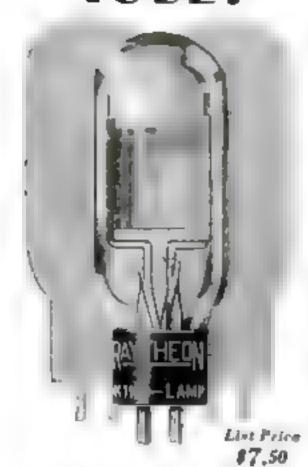
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Fighting Skipper of Air

(Lontinued from page 127,

igible that bears his name. There began a friendship that endured until the Count died seventeen years tater. On almost daily walks along the heastiful blue lake, the Count, who already had begus to build rigid airships, expoun-led his theories and hopes.

For a long time, Dr. Eckener, an eminently practical soul, remained skeptical. But at last he became convinced of the soundness and practicability of the Graf's ideas, and be joined the Zeppelin organisation.

Now Dr Eckener though an economist, was a navigator by nature. His talents along this line and his extraordinary gifts as a meteorologist became of great value to Count Zeppelin. and the subsequent development of airship operation was largely due to his efforts.

HUGO ECKENER was born in Pleasburg. in Schleswig-Holstein. As a boy, his passon was the sea, and much of his leisure was devoted to navigating a small suilbout over the choppy waters of the Baltic Sea. Even as a lad of high school age, he enjoyed some fame for his courage and resourcefulness as a sulor and his skill as a meteorologist. For this youth, in some unknown fushion, bad developed an unusual and almost uncanny ability to forecast the weather

But the era was not to be his career. The Eckener parents had determined that Hugo should become a man of acience—a Herr Profemor!-and to college he was cost. Here he specialized in economics, in which subject he took his doctorate with honors, a circumstance that explains his present thorough grosp of business and financial problems.

He also studed psychology at the Univernty of Lemuy, which conferred a doctor a de-

gree upon him in that subject.

All of the airship pilots in Germany were trained by Dr. Eckener, and in 1914 his work was extended to cover the commercial operations of the Zeppetin organizations under a subordury company called. Detail, of which be was made director.

During the two years just previous to the World War, Delag ships carried some \$5,000 passengers and meay tons of freight and express without a single accident.

OUNT ZEPPELIN deed to 1917 and was O microselet by his nephew. Baron von Geinmingen, who passed away in the spring of 1944, when Dr. Eckener was made the third preauting head of the Zeppelin organisation

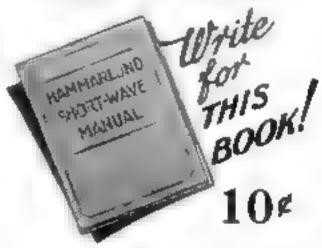
During the war, the Priedrichshafen plant had been built up to a expacity of one dirigible every two weeks! The technical problems surmounted at that time by Dr. Eckener, who throughout the period was Count Zeppelin s right-hand man, were the more exceptes because of the shortage of materials in Germany. Immediately after the war it was thought at first that the Zeppelin plant would be destroved. It was shut down, and Commodore Entreper was bearthroken.

It was not until after the famous flight of the ZR-# that the fate of the plant was finally decided. France insisted that it be destroyed. The German patents passed to the Goodyear-Zeppelin Company, of Akron, Ohio, at that time, and the Zeppelin works lost many of its necre'ls.

But the last few years of phenomenal aircraft development mave Dr. Eckener new hope of a real future for the plant, and on the wave of world-wide enthusiasm for aveation, he hegan the construction of his musicipiece—the Graf Zeppelin.

The enormous sky-ship embodies all of Dr. Eckener's theories of dirigible transportation. It is the fruit of his quarter of a century of experience as a husbier of great ascernit. Into it he has put all his skill as an engineer, all his genius as a designer of lighter-than-air vessels.

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Half a Billion New Stars!

(Continued from page 2),

lying right in the middle of the Mulky Way Among the strangest mysteries of solar space are the stars that appear to "run up a fever at certain times, become flushed and bright for a period, and then sink into diraness again. One of these is Algol, the "Winking Demon Star," whose secret was solved only recently. Exactly on the minute, every two days, twenty hours and forty-nine minutes, it suddenly begins to fade away, until in the course of three or four hours it loss four fifths of its light. A few minutes later it begins to brighten and, after three or four hours more, regains its former brilliancy. The puzzle was solved when a German astronomer showed that what memed to he one star was really two, one of which periodcuty colipsed the other. This was the first. expanation of the mystery of a "variable star one that varies in brightness, Six hunfred new variables were discovered last year Many of them have been shown to be but a single star, and the solution of the pumie of their periodic by lancy is one of the celestual engmas awaiting solution.

O'NL's the other day the Bergian astronomer, M. Delporte, reported that near Jupiter he had discovered seven nameless little planets whirling on their orbits. Again, when a moving point of light, labeled on the star maps RZ Ceptier, was clocked in a race against time, astronomers discovered that this star hamtually trues along the speedways of the sky at the rate of \$,500,000 miles an nour

The mention of such a distance is less startling than it was a few decades ago, when the universe was thought of as being not more than 45,000 light years across. Now we are tood that the distance across the whicking arms of a single spiral nebuse in the constellation Andromesia. measures 45,000 light years, and that that "pland universe" is a militon light years from the carth'

Before we can comprehend figures so vast, we must welk some comparison in our every lay. aves. If you began countary the seconds ticked off by your watch, and count night and day. almost two weeks will pass before you can reach one mi ton. If you count steadily for a year, you will arrive at a figure of something over thirty million. And during each one of those seconds, light travels 180,000 miles. Thaty million times 186,000 gives the number of miles contained in one light year—approximately six trillion. And that is but one unit of the millions and billions of which astronomers speak. It is believed that the new 200-inch telescope may penetrate unto space a billion aght years!

SO GREAT are these immense spaces sep-arating the beavenly bodies that we never really see any of the stars where they are. We only see where they have been. By the time the light rays reach us, the stars have moved on in their orbits. Students of the stars say it is entirely possible that at this moment rays of light are manons of miles out in space on their way to the earth from stars that no longer exint

A little over a decade ago an astronomer estunated that a cube one seven thousandth of an inch in diameter -so small it could by into your eye without bothering you—thrown into Lake Erie, would occupy the more amount of space in that body of water that the earth occupies in the known universe. Let the new telescope is to increase the size of that universe eightfold!

However, its greatest worth may be in drawing our neighbors of the sky closer to us. The moon, for example. Already the Mt. Wilson. telescope makes the moon appear less that 100 miles away, gives a photograph in which it appears to be thirty mebes in diameter, and shows as much detail as (Continued on page 190)



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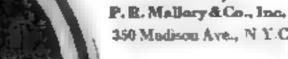
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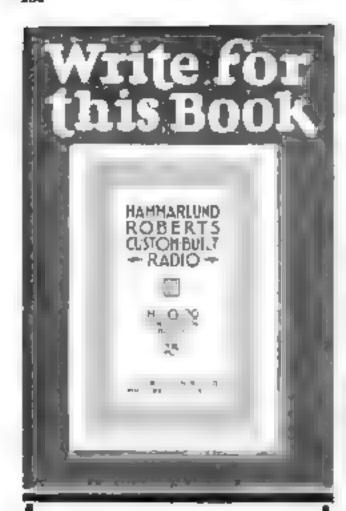
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Half a Billion New Stars!

(Continued from some 188)

is revealed by a muc-foot map of the world. When Mars comes under its observation, according to Dr. H. N. Rumell, Princeton astronomer, the surface of that planet will be seen so clearly that we can tell if the weather in a certain spot is warmer or colder than it was the night before! He says a nightly weather map of Mars" is entirely possible and that the much-discussed "canals and other features of the planet may be examined in great detail. It is entirely possible that the new telescope may at last give conclusive proof concerning the fascinating possibility of human life on other planets. For the detail with which a planet is seen depends upon the amount of light gathered by a telescope, and the 200-meh reflector will have a light-gathering power more than 500,000 times that of the human eye!

POPITAR interest in astronomy and its future soon is to be further increased by a "Theater of the Sky " to be erected near the Field Museum, through. Max Adler, a Chicagon interested in astronomy, has donated a half million dollars to build this first of American "planetariums."

A huge dome, sinety feet in diameter, forms a heavenly vault upon which the celestral drama is enacted. The audience, entering the theater, into in a circle about a curious-looking object in the center of the room, consisting of a stubby glass cylinder, with knobs at each end, mounted upon a rotating mechanism. The audience notes that each of the knobs is studded with tenses. Now the lights of the auditorium are lummed and the bare white yoult above assumes the shade of a blue nocturnal sky.

A switch is thrown and powerful electric lights flash on behind the leases, each of which project, magic-lantern fashion, a star or planet upon the dome above. Sides in the 119 lens projectors in the two knobs make it possible to show 4,300 stars, each revealed in the exact size and branance with which it appears in the actual sky. It took twelve years of experimenting for Dr. W. Bauerfeld, engineer at the famous Zerss optical works, at Jena, Germany, to perfect the remarkable machine.

The eviloder, with its knobby ends flashing their images upon the dome, moves slowly on its axis, duplicating the seeming diurnal roll of the beavens, while a lecturer tells of the romance of the familiar stars, pointing them out with a beam of light as he talks. The sun, move, and stars ascend in the east and descend in the west, each represented with scientific accuracy as to relative distance and britishey. The panorams of the stars in the southern bemisphere, or a duplicate of the celestial bodies as they will appear to the Byrd expedition on the Antarctic ice packs, may be flashed upon the dome of the planetarium as well.

The rotation of the planets may be speeded up so that \$6,000 years may be condensed into four minutes. The dramatic effect of the changing seasons, as reflected in the action of the beavenly bodies, is heightened by the mechanism which speeds up the action as much as \$,000,000 times. The start may also be placed in the exact position they are expected to assume ten thousand years hence, or in the position they occupied when seen by Cleopatra on the Nile or by the Cro-Magnon man peering from his cavern home.

Planetariums similar to the one for Chango have been established in a dozen cities in Germany and are in the process of construction in Italy and in Soviet Russia. New York has discussed the possibility of building one. Within the next few years, the building of the Chango planetarium and construction of the observatory in California to bosse the world's largest telescope are expected to stimulate new interest in America in this oldest of sciences. astropous?

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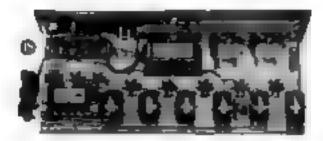
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Links in the Chain of Science

(Continued from page 48)

ingenious device, costing only \$20, is attached to a wing of the plane and draws off the exhaust. gases, many them to create a near-vacuum in which all notes is practically deadened. The siencer is constructed in such a manner that turefied, whirling air is driven deep into the engine and acts as a cooler. The use of his device, Carles says, does not diminish the power of the motor, but rether increases the number of revolutions per minute

The adencing of the propeller is more difficult. Considerable success is reported an secret trials in France with ax-bladed metal propellers instead of the ordinary two-bladed wonden propellers. A plane so equipped and with external wires and projections removed as far as possible is capable of practically

nomeless flight.

THIS question of noise is attracting more and more attention from scientists as population tends to congregate in cities and towns and transportation systems multiply; for eighty percent or more of city noises arms from automobiles, electric rail envs, and steam roads. Dr. P. C. Dockersy professor of psychology at Otoo Wesleyan University, reports that a little noise may act as a stimulant, like a cocktail or a cup of coffee, while too much noise long continued might ared a person to an manne asylum.

But whether or not noises stimulate us, they are annoying, and at the Massachusette Institute of Technology, Luther A. Gaw, of Cincinnati, has just announced an automobile engine that is reported to be virtually nosecless. His is a four-cycle engine with a single sleeve valve. It has fewer working parts than any other similar engage. It is shown in a photograph on

page ferty-eight.

The man who saked "What's the good of science?" probably sees no great value to humanity in the study of the whale a section of disposing of the carbon dioxide generated in the blood during long periods under water which is bring undertaken by Dr. A. Bruner Howell, anatomist of the Johns Hopkins faculty. But this is a occret, which, if it can be discovered, may be of tremendous benefit to man. A whale can remain under water without breathing for an hour or longer. In the case of any other warm-blooded enimal, suspension of breathing for that period would cause death from the curbon dioxide which would be stored up in the blood because it could not be exhaled through the lungs. An understanding of the chemical adjustment which must take place in the whale's body to enable the animal to conname its own poissons may had to the discovery of more chemical method of life-preservation in submarine and more disasters.

ONE could go on almost indefinitely pixing up answers to the question "What's the good of science? for scientific discoveries and their applications in the industrial arts are multiplying so reputly that so single brain can possibly greep more than a fractional part of the new knowledge that the world is gaining. The best that anyone can do, outside of his own special field of activity, is to glance at the igh spots" of scar develop. And this is sufficient to demonstrate that the efforts of science are practical in the extreme, and are constantly reaching wider fields of quefulness and uncreasing the constart and happiness of all men.

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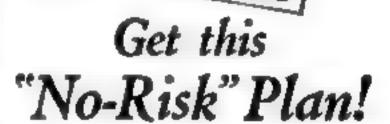
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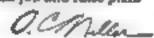
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CATTS a perfected sends willing the per raine.
Agence entiring doors, this provise I studies the Mission Secure, 2 page W. Floo, Loo Angeles, 5 and,

Don't spoil the party!"

.. someone called when I sat down at the piano



WAS just about in enter the room when the

What put about in enter the room when the entered of my paper cought my attention for with the seem the seem to have Dan with the again. Bull was asking about me.

"Maybe. I weem too south the end times." You do better lock the parts.

"Interpreted the won't have the agers to play after what happened the seet lone."

That whe a shately trick I almost wish we hadn't put ed.

Into wol. I know what they were taking about? You, it sees a shately trick they had played on my list, looking hand, I that y wouldn't blare there.

Let me tell you should that can party. Jolly, at me tell you about that cast party

informed all the guests out friends of more I had not shown at he paster and friends of more I had not shown at he paster and in my waster inherential playing some popular numbers light before I had played more than two or breek pieces I had played on snaps at large I stopped to snaps, turbed around, and now the come was

furtened of entertaining the party, as I had foodly invaried, my having, stumbing performance had

perto a topographice

Printing with shame and indigention I deter-tioned have nothing more to do with the friends, who had let me make a final of moself when butdelay it occurred to me has been I resuld turn the tables hat there was a way in

t arctally according the crowdle" parties. I had below my may no if I was absolutely certain that I could put my plan over At last, tonight, the number had come

proposed had come (as at a walking late the Poors, I pretended not to make the guilty expressing on Bull's face as he well mad use. Every one seemed uverloved to see had ago a servicesty glad that I had evidently forgover and forgotten had year's treet.

chapter y I turned to Rill and soul. Hope you we had the parametered, and boy I feel just in the mond

netnet y the friendly atmos-phere thoughd. It was unusing to see the look that spread from face to face. For a moment no one spoke Then, just as I was of true down at the place, some

from that piace! Don't specifie

Party
That was my can. Instead of replying I attuck the first bate of Shandown And how! Ensury and expression I had always bringed her!

Game arm the halt og, nerve-racking heatatase, that had formerly made my playing a cortare to the listeners. No wooder the guests garped with arms ment. Placemeted, scarcely believing these ears they down hearer. When I finished they lookly ears they drow mearer. When I finalled they loadly clarated for core. Time and again, when I would have emproy. They superfy mostled on Just can be a superfy mostled on Just can be a superfy to the superfy the more, pleme

How I taught myself to play without a teacher

When they finally atlaned inc to seave the passed I turned around and and

Just a manners, toka [mant to thank you for what you did for my last year

The exact roughing laces turned red with emineran-ment One of in of the bujumurmumi as applica-

their configure, I could need to be a duly at passed my eyes 1 dears had a duly at passed my eyes 1 dears had a duly at passed my eyes 1 dears had a duly at passed my eyes 1 dears had a duly at passed my eyes 1 dears had a duly at the passed my eyes a least And between the take, when I chank of the passed least a duly at the passed least a dul

of prints that there. I the entire marry pleasure | get nut

produce the part that there exercises that night had concernd now and soul, hasten, then, I want an explanation.

Her did you do it.

If aughor Why I just to de advantage of a term way to learn major that a m. ? Didn't you take remain room a tracker?

What do now mean new way? Didn't you take remain room a tracker?

Which Instrument Do You Want to Play?

Voice and Speech Culture Automatic Finger Control

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Plane

Pierola

Guitar

Clarinet Utulele

Hawallen Guiter

Drums and Trage Mandelin Sight Singing

"Absolutely" You've heard of the U.S. School of blight haven't you". That you correspondence when I not us?

her, when that their showed the up art year I wan for me of their free deprendent on be no much council than I had begin for that I wan for the complete example And believe the I me might glad I did to the the complete example to the I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I had believe the I me might glad I did I me might glad I there man't any expensive private teacher to pay and more the leaster came by mail dedo't have to set andr rais-

tes, when that trick showed

able bours to simily. I practiced only in my opure time. a few minutes a day. And the course is minutes a day. And the course is thorough! Why almost before I have it, I could play macking rhappodies, man!

You needn't know a thing about music to take this pleasant, rapid COURTS

This story is typical. The amazing surees of the men and somes who take the U.S. School of Mose occurs is largely due to a newly perfected method that makes reaching and playing monic so simple so A

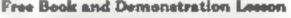
Even if you don't know one note from another how, you can easily group each clear inspiring lession of this surprising course. You sength can't go wrong shows you bow, then you do it yourself and beer it.

Thus you actually teach yourself to become an personage sited in moments of the best from house. We though any long hours of tedinos practice. We though pay that or upintered up ember you make how to

a moment later they

got the surprise

of their lives!



The wonderful illustrated Free Rook and our Free Demonstrates Lemma explain all along light remarkable rection. They trave for how anyone can learn to play the favority instrument by said, its almost per time and for last a travelsm of what old slow methods cont.

for Jun a traction of what old alow methods cost.

Assemblet 44 is not two late to become a capable applicing. If you are in earliest to become a capable applicing if you are in earliest begin to place happiness and horse-way your popularity many to pale now happiness and now. I sept the old-fastioned idea that to the internal means excepting. Head the list of fastionments to the internal excepting the root to play and the list, School at Master with do the rest. At the deviage post of only and the largesting free Book and the largesting free Book and from Inchesion to high and the largesting free Book at the Pro- Inchesion to high and the largesting free Book at the Pro- Inchesion to the Research of Lemma will be sent to you at other. No obtigation I is Believe at himself, New York Itty

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What the World Owes to 1928

(Continued from page 29)

henceforth certain body colors, lines, and transmings will have their vogue.

More interesting to the technical mind have been the efforts toward greater comfort and convenience for driver and passengers. Easier riding has become a scientific study. Instruments are replacing human judgment in measuring riching qualities, beloing to better correlate springs, abook absorbers, weight distribution, sent cushions, tire sizes, and pressures, to allow faster comfortable riding and longer driving without fatigue. Vibrationless power transmission is being sought, and we find more use of rubber insulators in engine and other mountings, better engine counterbalance, vibration dampeners, lighter reciprocating parts, quieter gearing. We have easier gear shifting, simplified chassis lubercation, quicker pickup through more power, and less turing steering and braking mechanisms.



PSYCHOLOGY

A. D. POPPENBERGER, PH.D. Deportment of Psychology, Columbia Democraty



DSYCHOLOGY today has shifted emphasis from intelligence to emotion as a motivating force in human life. Further, the emotional makeup as an thherited and fixed possession of the individual has given place to a more plan-

tic natural status upon which beneficial emotional impulses may be developed and harmful ones avoided. Heavier responsibility thereby falls upon those who guide the child through its earliest years when its motivating forces are in the making.

Hand in hand with this interest in emotional life there goes the attempt to measure it and evaluate it as an ingredient in success. Tests of temperament, character, and emotional stability are as numerous as tests of intelligence.

A specific achievement of great importance is the discovery that adults, unlike old dogs, can learn new tricks. It has been demonstrated that adults can learn such things as they need to learn almost as readily as the child or youth.



METEOROLOGY

CHARLES F. MARVIN, M.E. Chaf, U. S. Wrether Burren

N IMPORTANT meeting of Euro-A pean and American meteorologista was held at the Pans office of the French Meteorological service during the third week of May, 1928. The purpose was the better international organization of weather observations and reports from ships at sea, especially those plying the

North Atlantic Ocean. Plans contemplate the extension of the work to all oceans as far and as soon as practicable.

This program of extension is the great forward outlook and step of the present



time. been the dream of meteorologuita for fully fifty The years. ndvanced stage of development of communication over the oceans by radio makesfulfillment of the hope posable and gives promise of its early realization.

As the organization is developed, each nation is responsible for securing at least two, and if possible four, observations and ratio reports each day from certa o selected aluga of its own registry. The weather conditions over the oceans will then become as well known as those over the land. The information is of vital importance to the safety of life at sea and to aircraft flying over the oceans. Several huge passenger-carrying ausbipaare now nearing completion and the meteorologists of the great maratime nations are eagerly collecting to supply transoceanse aircraft of all kinds the best possible wenther service.



MEDICINE

MORRIS FISHBEIN, M.D. Middler, Jauenal American M. d. to homeostion and Hipport, the Month Magazine



VITAMINS continued to engage medical attention during 1928, increased interest attaching particularly to the possible by of vitanun B deficiency in the American diet, and to the

relationships of the new vitamin E, especially to sterility. The possibinties of dangerous results from too much vitamin and from vitamit imbalance received.

extended consideration.

Ultra-violet transmitting glasses lost popularity through establishment of the fact that in most large cities an insufficient amount of ultra-violet penetrates through from the sun. American women reacted. favorably to public health education and the cruse for weight reduction began

It was found possible to transmit yellow fever to a certain form of African monkey, thus making it no longer necessary to carry on dangerous human experiments. Investigators in the Univernitrootain lo via (Continued on page 140)

"How I Laughed Myself Into Success in Radio"

by Howard Clark,

"I'm sitting on top of the world! My bank account is growing fatter every day ... my home is all paid for ... I've just ordered a new car ... and my wife and I can at last enjoy life in real style. It sure feels great to be earning by money. And to think how it all came about!"

IT happened on a rainy Monday night, I was reading a magazine while Mary was clearing away the supper dishes. Suddenly a funny carroon caught my eye . . . and I laughed out loud.

"Jim, you make me eick!" she cried. "How can you laugh while I'm nearly dying of westness!"

"But Mary dear-"

"Don't dear me, you idlot!"

I was alarmed. "Great heavens, what's wrong?"

"Wrong?" she screamed, "bere I drudge all day, do my own housework, wish all the clothes, take care of the baby, and worry about your meals. I never get a moment of freedom . . . and haven't a decent thing to wear even to church . . . yet you never seem to care!"

I was ashamed!

A feeling of shame swept over me. So that was why she seemed an "moody" the last few days! Like a good sport she had suffered in silence until she couldn't keep it in any longer. Poor kid!

For hours after Mary had gone to bed that night I kept staring into space. What a mess I had made of our lives . . . What a slave I had made of her.

Listlessly I kept thumbing the pages of the magazine... thinking... thinking. Was there no way out of it?

Then suddenly ... as if by some kind act of Providence I stopped before a story. It told of a fellow who had made quite a fortune in an uncrowded profession. Fascinated, I read on, It told of the brilliant opportunities in the radio industry ... of the big incomes fellows like myself were earning ... and of the ease with which export radio training could be acquired. But what impressed me most was the



fact that success was practically assured by means of a new home-study labocutory method spousored by three of America's great corporations.

With gignetic enterprises like these behind a school I needed no greater guarantee so without a second's further hesitation I tore the coupon and mailed it.

A lucky event that changed my life

It sure was my lucky day, when the first lessons came in. I never dreamed that learning radio was so cary. I didn't know the first thing about it when I started. Yet before many months were over I was able to solve many of the problems which command big pay.

Each subject was explained in simple word and picture form. It carried me along like a novel. From magnetism and electricity the leasons took me step by step through throuble-finding and repairing—through ship and shore and broadcasting apparatus operation and construction—through photoradiograms, television and beam transmission.

I didn't have to give up my regular job. I stayed right at home and learned during my spare time. I actually learned by during. With the leasons I received a complete, expensive storehouse of apparatus with which I was able to build radio circuits and acts of almost every description. Yet it cost me absolutely nothing extra.

As a result of this practical, technical working out of big radio problems with a fine home-laboratory, I was able to earn good money even before I had completed my course! And it wasn't long before I was able to quit my regular work entirely... and branch out for myself in big paying radio jobs.

Today, I have more work than I can take care of. And I often make more money in a day than I used to earn in a week.

Read this thrilling Free Book

Howard Clark's scory is typical of the success which scores of

other men have achieved . . . through the "big-league" training given by the home-study course of the Radio Institute of America ... the only school in America sponsored by RCA, General Electric and Westinghouse.

Radio needs you. Manufacturers, dealers, broadcasting stations, ships... all need trained radio experts. The pay is big. The opportunities are limitless... The work is thrilling! Find out all about it. The Institute has prepared an interesting, illustrated booklet telling you all you want to know about this vast industry and about the remarkable home-study course that can fit you for a brilliant radio career, Just mall the coupon be-

low . . . the booklet is absolutely free. Radio Institute of America, 326 Broad way, New York,

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What the World Owes to 1928

(Continued from page 188)

discovered that copper is a substance of greatest importance in relationship to the formation of the blood in the human body. Heretofore it has been the general belief that iron was the chief mineral salt of importance in this connection.

Work on the blood indicates the possibility of determining eventually parentage and heredity by blood examinations. Surgery finds it possible to remove one balf the human beam with recovery of the patient. The cause of measles is not yet determined, but investigators approach it closely. When the cause is fixed, a skin test and serum for prevention will be possibilities.



PHYSICS

G. K. BURGESS, D.Sc. Derector, C S Bureau of Standards



ТНИВАГО. Hunt, Osborne, and Hoag, working independently with gratings, have together succeeded in ondging for the first time the gap in the spectrum between X-rays and the ultra-violet region. X-rays now form a beanch of option.

Franck, Birge, and Mas Sponer have shown that the heats of dissociation of chemical compounds can be determined from spectroscopic measurements.

Raman and Krishnan have found that when liquids are illuminated with monochromatic light, the scattered light contains not only the original line but other emission lines of both shorter and longer wave lengths. This lends further support. to the conception that the liquid molecule contains electronic systems vibrating with definite frequencies, upon which the impinging monochromatic light reacts to set up new wave lengths. According to the new wave-mechanics, electrons are nothing but wave systems. Sir J. J. Thomson points out, however, that if an electron is regarded as an essemblage of lines of force, starting at the charge, it has definite frequencies and can absorb and transput electric waves even when the center remains stationary.



EXPLORATION

GILBERT GROSVENOR, LL.D., LIFT.D. Procedust, Hotleant Gospouphic Society

ADVANCES in geography and explor-ation were more than usually marked by steady progress all along the line, The ill-fated Nobile airship voyage to the North Pole was the tragedy of the year, although taken with the successful Wilkins-Eielson flight from Alaska to Spatzbergen, it. (Continued in page 141)



Making Good in Aviation

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What the World Owes to 1928

of outrained from Page I at

helped to disprove the idea of the existence of a great land mass in the lutherto unanyaded regions of the Arctic.

There were scores of expeditions in the little-explored sections of China, in the interior of Africa, and in the inner Amazonian empire. Advance reports in-



dicate that they have brought back a wealth of information about littleknown areas. Among these expeditions was that of the National Geographse Society to the Paylof Island volcanos off the Alaskan peninsula, headed by Dr. Thomas A. Jaggar.

The sea also was made to contribute to the growing fund of knowledge. The perfection of gravitation-measuring instruments made possible new determinations of the weight and shape of the earth. The American and Dutch navies contributed the use of aubmarines in these undertakings. Sonic depth finders were employed in every ocean to trace out the terrain of the sea floor.

The year also was marked by the departure of Commander Byrd and Capt. Sir George H. Wilking for the Antarctic to lay mege to the secrets of the Antarctic from opposite ndes of the continent.



ANTHROPOLOGY

Ales Hedlička, M.D. Curator, Devision of Physical Anthropology, U.S. Antonial Massum



THE main advances in anthropology during 1928 were in the field of prehistory of the Old World. Further excavations by Absolon in the vast Aurignacianstation of Vieston re. Moravia. brought the number of specimens recov-

ered to over 300,000, and culnimated in the find of a human skeleton with a remarkable necklace of Arctic for teeth Wesdenreich published the first account of the highly interesting new Einingsdorf skull. Miss Garrod, Buxton, and Elhot Smith reported on the new Monsternan find, including a child's skull of tabral tar, And Hedhéka in his Huxley lecture showed that in the light of present evidence acience is no more justified in excluding the Neanderthal man from our ancestry A valuable find of later prehistorie skeletal remains was brought from British East Africa by Leakey.

In America archeological work was carried on in Yucatan, Guatemain, Honduras, and the southwest, by Carnegoe, English, Smithsonian and other workers.



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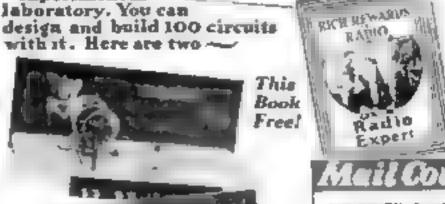
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The Real Fathers of Flight

(Continued from page 19)

Peter Pan and Orville Wright are related to each other! The latter is perhaps sheer and more sensitive than his fictional counterpart. At the same time he has iron in his soul, an endless tenneity of purpose within a frail tasty and a detente nervous system. He is full of gentle humor. Hawthorne and ticlett Burgess are his favorite authors. He likes The House of Seren (others and equally The Purple tow. He used to churche with lelight over the absurdates of weird myentions as depicted by Rube Goldberg, the cartoonist.

The child is indeed father to the man, emphatically so in the case of the Wright heathers. Their boyhood illumines and makes credible their amazing achievement as men. It is evidential and vital to the history of the acquire So I am going to tell every least boyhood take and anerdote amag with other matter support to me by Orville, Authorize, and their father, who is now dead.

THE family is of mixed stock—English Holland, and German-Swise. The earliest ancestor bases Weight, descounted by preacher, left Esser, England, to come to this country, and he witted at Springheld, Mass, in 1630. His great great grandone, Dan. mixed in 1816 to Centerville, Ohio, now a suburb of Dayton but then a frontier point almost in peril of furking Indiana. Here the son and namesako of Day, grandfather to the proneers of the air, married in 1818 Catharine Resiler, whose lather had been tilled by redskins. Her mother, Margaret, had been the first white woman in Dayton which was partly founded by a brother, Henganian Van Cleve, after whom one of the present with holisis is named

Million Weight father of the inventors, was been New 17, 1988 in a log cabin on a form in Rush County Ireliana. The cabin was "pretty west scatched," having the outside of the logo scate scatched, "having the outside of the logo scate scatched, "having the outside of the logo scate scatter, but a fine axing room that served area for belowing kitchen, both, and what you will be short a one-mon cabin with a good fireplace. Tallow candles and pitchpine knots. The farm equipment consisted of one or and a wooden plow with iron shoul point.

MILTON was converted at eighteen and puped the United Brethren Church, a seet which derived from the Lutherans, prospectal among the herman Americana of the Madde West and once had about 160,000 adherents. He studied for the ministry at a little college called Hartsvule in a town of the name name in Indiana. A fellow student became his wife and the mother of the inventors, blic was Susan I atharine knowner, of German-Swiss extraction, and was born in Hillsboro, Virginia, April 10, 1831. Her father was John Gottlich knowner a wagon maker, born near Schleitz, freemany, who field to the country from military conscription of the Napoleone eraction of German-Swiss descent.

Perhaps the student of heredity can draw some conclusions from the mature of meal strains, dogged, substantial, and alert.

hather knowner had a shop in which he built farm wagons and carriages. It contained a turning lathe operated by foot power probably the first machine ever seen by two little boys who were swed by it and that not dream they would become considerable mechanics themselves.

Orvite Wright well recalls Grandpa Koerner who took him, a little tail, between his kneen, We can imagine the grossless old man multering: "Ja, ja, I could make you a good wagon-

builder, ver'

The parents of the inventors moved around after their marriage, the husband combining

school teaching with farming and circuit riding. They stayed two years on a farm true bar-mount, Indiana, which was enlarged to some use in time and remained a family property. The house was a log calon of three rooms. The first of this was been here on Marc. 17, 1861. He was named Remain, after a German theologian. The father picked out the mimes of all his some and worked on the theory that Wright, being common, needed an unusual handle.

Milton became a prending elder of the Luited Brethren and on the death of his father took his family to spend a winter with his mother in Fayette County, Indiana, where the accord child, Lorin, was born Nov 18, 1862. The name of Lorin was picked offhand from a map, it just looked good. There was a removal to Dublin, Indiana, for a couple of years, and thence to Miliville in the same state for a stay of three years.

SOMETHING important happened at Millville, or, more exactly, two and a half miles northeast of that hamlet, within a frame boune of five rooms. Walker Wright was been here on April 16, 1867. The co-inventor of the airplane was named after Wilbur Fishe, a personage in the Methodist Episcopa; Church

Again the family moved, this time to Hartsville, where the parents had studied and courted. Now the father was minister of a church and also taught theology in the college. After a year he left to become editor of The Religious Telescope, a weekly church organ, at Dayton

A small house was bought on Hawthorn Street about a mile and a half from the center of Dayton, then a sleepy town instead of the throbbing industrial city of tostay. If in house was the family home for over four decides. Orville Wright was born in this dwelling on August 18, 1871. It was the only home of Wilbur Wright in his manhood and the place where he died. Moreover, within these four walls the airplane was largely engosived and created.

IT Was a little frame structure with wood shingles on peak roof, wate ciapboards painted white, and green shutters at the windown. There was a small porch at the kitchen and. A partial cellar extended under the high room. The new owner raises the back roof so as to have four hedrooms upstairs, matching the number of rooms below. No plumbing and no bath. An open well with a wooden pump at the back door was the water supply this lamps gave light, coal stoven best, and cooking was done with firewood in the kitchen range. The lot was there are not a half feet front and 130 feet deep. The house and lot probably had a total value around \$1.500.

A few improvements, including some done by the hands of the inventors, were made in after years,

Orville, who arrived here, following twins who died in infancy, owed his name to Orville Dewey, a I mitarian minuter. His familiar title became fire and firey. To his brother Wahur he was latterly Bubbo, even in letters, while his sister Katharine addressed him as Bubs.

The unter and last child—who plays a vital rule in the historical drama of the airplane—saw daylight on Hawthorn Street on August 19, 1874. It was thought a nicky economy that her bertiday concuted with Orville's Catharine was her name by due inheritance, but the Cauou shifted to K through the abort form of Kate. A relative bestowed the little of Schwesterchen, or little sister in German, which a children blunder spot into two nicknames, Sweet and Sterebens. The latter especially became Katharine's appellation in the home and in letters by —Common an age of the

The Real Fathers of Flight

(Contraved from page 148)

her famous brothers. The Rev Mr Wright, as church editor, had a salary between \$1,000 and \$1,500 a year. This was a good income compared with a maximum stipeed of \$000 to his circuit-riding days. Thanks to his wife a careful housekeeping at was enough to provide fairly well for the family and also to put by something for the future. There was enough plate food on weekdays and a good dinner on Samlaya. Clothra were made over down the line, starting with the retired broadcloth of the minister, so that each child was devently clad-

Mother Wright was "just worshipped" by her children. Hise had time to play with them while doing all the cooking and housekeeping, making new garments for the minister, and remodeling custoffs for the youngsters, menditig, datumg, sweeping, washing, even culting the chadren's hair with or without a bowl to guste the seasons. At night she listened to the editorials written by her lemband for the Telsecops. He read them aloud to her and took heed of her comment and augmentions for changes. He depended on her to keep his style simple while he availed himself of her fertile and vivid ideas. Doubtless he was influenced by her to become an early advocate of woman suffrage. Long after her passing, Bishop Wright, at eighty-six, marched a mile and a half with his son Orville to a suffrage parade through Dayton.

SPRIGHTLY and keen witted, Susan Wright had an original mind and a knack for invention. She taught herself to design clothes. She made and fixed things around the home. She gave an example to her youngsters in self help. tankering, and creating. A sled was wanted me water by the two older boys. There was so movey to buy it. So the mother built a sied with her own hands and it was just as good as a store kind. She was apt with tools and clever with her hands—unlike her husband. Perhaps she inherited deliness and the creative sparit from her father, the German woodworker and carrage maker, and passed on these gifts to some in whom they were intensified to an illustrious degree

"Have you heard the latest about that boy Orville?" mud one gowiping neighbor to apother "Only seven years old and he and another boy have a little wagon and they go around picking up boses and sell them to the fertiliser factory

Do tell! I wouldn't let my youngster do it. Why, you know a fertiliser factory meells accepting awful.

"Of course. It's terrible. I bear he finds out which way the wind is blowing and only delivers when it's to the factory

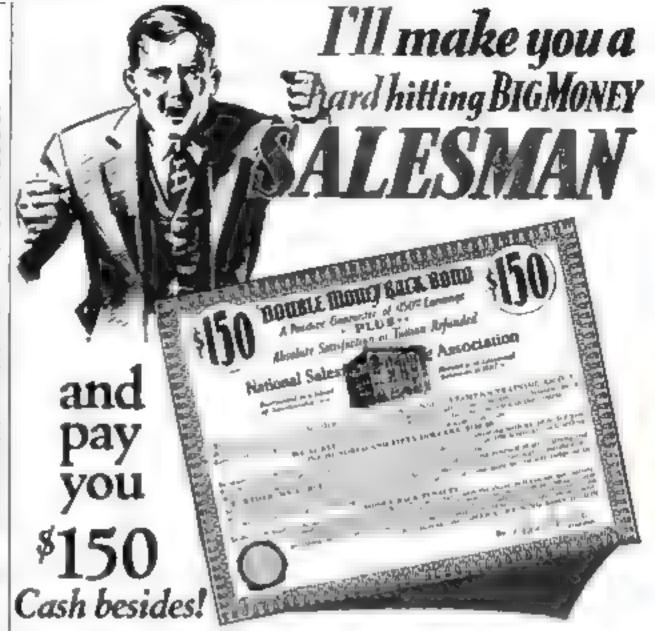
Only, if the wind changed, he "Mercy

might be afflicticated.

The proceeds of the hone traffic west to candy and fishing tackle. Orvole lost one good length of fish one owing to his asbit of maring things on land. He tossed a soure into an alley roping a pig that galloped off with yards of valued fish line.

Making from was an early passion. Aided by hu pal, Ed Sines, he started a blaze against the back fence of the homestead. Three-yearold Katharme ran and tattled to her mother, who put the fire not - It took a long time for Orville to forgive his sater for tattling and be still likes to make and see fire, the larger the

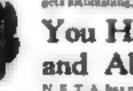
An event which seemed quite trivial at the time but now appears a agropost on the road of destiny happened when Wilbuz was eleven and Orville seven years old. The father went away on a church trip. He thought the boys had been pretty good lately and be would buy them a present "Boughten" gifts were somewhat rare in that fragal home. Yet he liked to bring bome a few (Continued to page 140)



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The Real Fathers of Flight

(Continued from page 145)

cheap kmckknacks for the family. An odd toy caught his eye in the city store. It was expensive, a useless plaything at the price of a greed shart, a hymn book, or a pair of copper lued shoes. He hestated. He examined the foolish doodad, was fascinated, and yielded to the extravagant arge.

UPON a late autumn evening the father walked into the fiving room of the Hawthorn Street house with an air mysterious, his handa covering some object.

"What is it, father? What is it?"

Something for you boys." He mailed down nt the children.

"Let me see it! Please, father, let me! I such it first?

Watch now."

"O-b-b-b-b" gasped the owe-stricken youngsters as the father opened his hands and a sluby thing leaped into the air. It rose whirringly and smote the cribing, fluttered a moment as if undecaded on its next course, and then mak slowly to the floor

"It a a bat' shricked the costatic lads. " A flying but! Iso tat, father?

"No," we can imagine the response, "it is not alive. It is a muchine. You see it has two little fans that whirl around because of the puls of this twisted rubber hand. The frame s cork and bumboo and the rest is paper. So it is very light. I guess these fans push against the air just as a ship propeller pushes against water Perhaps there is some likeness between this machine and a but or bird. Anyhow they both fly. This is a sesentific toy. I won't ask you buys to spell its name. It is called a helicopter

FOR the next few days the flying but was put through its paces within the house and out in the back yard. It had a stremuous tryout at the hands of two outhusastic and ruthless experimenters. They were at it morning, most, and might. They subjected the motive power to a cruel strain. They sucked and tore the fragile device with eager fingers, loudly warning each other against violence.

"I reclare, those Wright boys are perfect terrors' remarked a cross-eyed neighbor, discussing the news of Hawthorn Street with her best friend.

What have they done now? "

"Why, their father bought them an expenseve toy. I hear it root fifty cents. And in no time at all they tore it ail to pieces".

"What a shame Minister s sous, too." "That a what I say I don't see bow such destructure little believes will ever amount to

anything! Now my boy-

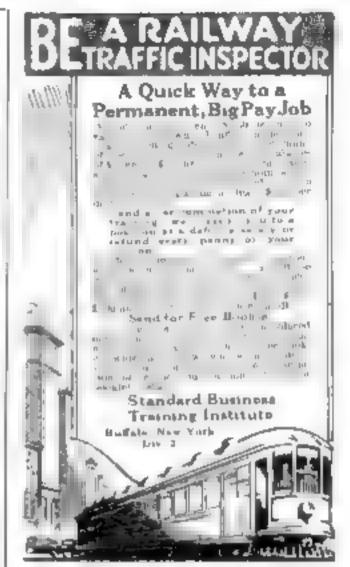
Meanwhile Wilbur and Orville Wright had blimful dreams around an experience pever to be effeced from memory. That heautiful marvel! That lovely thing that acted like a living creature of the road'

It as a machine. Father said so. The fans go round and round and push the air. They o so fast you can't see there. Paster but a wings. It is a flying bat, like the one that went through the attie window. It might he a bird, the same as those that fly around

Oh, if I could fly like that'

Destiny smiled tenderly on the sleeping lada.

N ANOTHER absorbing chapter next month, Mr. McMahon tells the story of the Wright boys' early experiments in the mechanics of flight, interweaving fuscinating antedotes and dramatic incidents. You won't want to miss a single installment of this remarkable





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Popular Science Monthly Note Tork, H. T. 25F Feerth Are.

earn Electrici

Fires Start Themselves

(Continued from Page 5.)

ing cases of magnesium powder—a photographto flashlight material—decomposed. Streams of hydrogen gas filled the elevator shaft and exploded, killing several men.

Fire experts are beginning to recognize a hitherto unsuspected basard—what is known to chemists as "estalyeis," the ability of certain metals and other substances to promote chemical reactions, including explosions, in seemingly impossible circumstances. For

GLAMPIC

Filing cabinets were being baked in great enumeling ovens at a Rochester, N. Y., plant not long ago. Bensal fumes from the enamel solvent filled the ovens, which were kept carefully neveral hundred degrees below the heat at which the fumes—it was thought—could explode. Yet one morning an attendant opened an oven door, and the resulting blast threw him hodily across the room. Experts who investigated advanced the povel theory that the steel in the oven may have auted the chemical union of hensel vapor and air that produced the explosion.

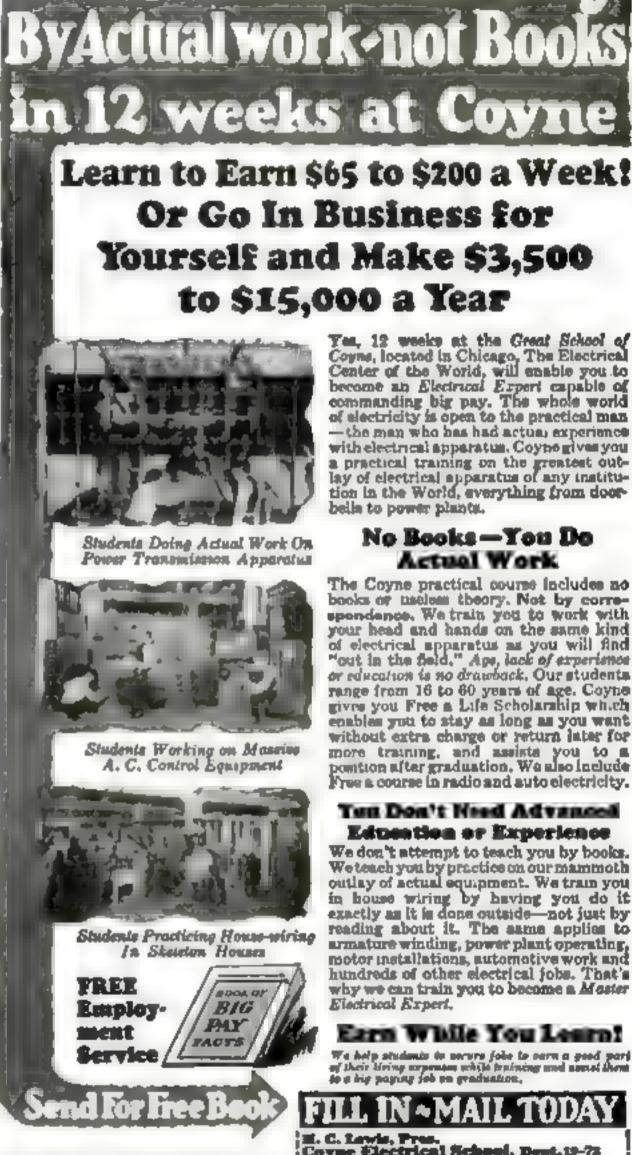
WHEN you sould across the carpet, on a clear dry day, you may notice a faint spark fly from your finger tip as you touch a metal fixture. That baby spark of "static elec-tricity," in other circumstances, is the base of firemen. It can cause anything from a gasoline filling station blase to a dust explosion that will wreck an entire factory.

Many are the stories told of gasobne tank truck fires from static spacks; most trucks, in fact, drag metal chains along the ground to carry off harmleady any electricity that may be generated by the swishing laquid within. But who by some peculiar condition of his body seemed to be an extraordinarily good electric

Thu man, a driver for an Arisona oil company, burnell up three tank trucks before they ensight him at it. Each time the elecumstances were the same. His truck carried five-gallonpails which were hung on the cocks at the rear of the truck and delivered, two at a time, to the consumer. By the time the driver returned with two empty pails to substitute for the full ones hanging ready, he had acquired a new electric charge and a spark would leap from his fingers past the inflammable gasoone Poff -and another tank truck would go up in flames. Finally the man was transferred to another department where his dynamo prochyities could do no harm.

WHEN the Massachusetts State Police, some time ago, investigated a number of entomobile firm at filling stations, they found that the mere passage of gasoline through a filling hose generates enough static electricity to grite the car's tank, under favorable circumstances. Probably you may never see your car catch fire at a gas pump, because these accidents are rarer than they once were; thanks, largely, to the lower inflammability of presentgasoline. But if the metal filling notale is held away from the rim of the tank opening, a dangerous spark way jump a half-meh between them as the rushing gasoline piles up an electric charge on the nossle. It is safer to let the nozzle touch the tank rim constantly during

Amateur dry cleaning is one of the primary fire hazards in the home, due again to static Swishing silks, fure, or leather in gasoline is an rical way to generate sparks, which are likely to leap just as the material is withdrawn from the liquid—particularly if the cleaning is done to a pan on a wooden table, which insulates the electricity and prevents it from running off harmlessly to the ground. Any such work is best done, if at all, out of doors, where inflammable vapors usually (Continued on Super 144)



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Fires Start Themselves

(Continued from page 1-5)

are quickly dissipated. That even here this is not always as as shown by a case on record of a smoker who ignited vapors from a wrecked gasoline tank more than 150 feet away

One wome dissiration is that of a woman who, shortly before she was to deliver an astirem on the hazard of home dry eleaning, washed her urm-length gloves in graoline. Having donned them to dry them smoothly, the was rubbing out the creases, when a spark united the gasoline. She died from burns received before she could strap off the gloves.

Many oil tank fires of mystersous origin are believed to have started by static sparks. A meer twenty door drop in an oil pape may create a dangerous accumulation of static electricity by the time that oil reaches the lower outlet.

Event manager belts are whereing or VERY industry, in fact, knows the menace cylinders turning, in newspaper, textile, or rubber plants, there is the chance of a spark that will touch off anything inflammable near by. Once the Department of Agriculture investigated a series of strange fires that started in givat combination cutting and threshing machines, each time destroying the machine and spreading to the entire field. Static sparks, it found, smited the wheat or other produce in the machina. Wherever wheat rust, a disease that transformed the wheat into almost pure charcoal, occurred, the trouble was greatest. When threshors were equipped with electric connections to the ground the fires

Dust menu hardly a likely mores of five; yet, suspended in the air is fine particles, it may be a more powerful explosive then dynamite Nummum dust wrecked a Bacine, Wis., plant when it was ignited, presumably by static electricity, during its manufacture for use in silver paint. Here the metal, reduced to powder, because highly inflammable. Esther static sparks or electric lamp connections may have ignited the pyronylin lacquer dust, a substance used for paint spraying, that exploded and rased a Detroit, Mich., factory last year The dust of sulphus, hard subbes, sugar, and cork, to mention only a few, have each caused a number of trage explosions and fires.

In marked contrast to the lightning-swift consequences of a dust explosion is the slow, smoldering birth of spontaneous combustion. Oil- or chemical-maked rags are the most familiar causes. But, so one incident above, they are by no means the only ones

WITHIN a red brick newspaper building in New York City, one night, printers were making ready the preses for editions of the following day when one of them mw unoke seeping through chasts in the board partition separating the plant from a eight store pext. door, closed for the night. Entering the store they found shelves liming the wall to within two feet of the criting, filled with boses of figure—and, atop a shelf, an eight-inch pile of newspapers that expeed a telltale trail of smoke. In a moment the fire in the hurning papers was slamped out.

Examination aboved that the scorebed shelf, a solid one-such plank, had not been burned through from below. And the papers had been charred, not on top of the pale, but beneath and mode it. There was but one possible verdict-"spontaneous rombustada.

Experts explain that, given three circumstances, spontaneous combustion will surely follow. The first is the real cause—quality, an animal or vegetable oil that will turn rancid. I shod, inseed or other "drying oils" used by painters, even salad oil may suffice. Next in the tender; any inflammable material, such as rags or paper. The last requirement is that there materials be confined so that the heat will not escape, but will con- (Continued on page 147)



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A definite program for getting aboad financially will be found on page four of this leave.

Fires Start Themselves

(Centrauré from pour 146)

timpe to case the temperature of the uddamma-

be more against catches fire

A tight-piled mass of oil-soaked painters' rags fulfills these conditions ideally. Action of the air a axygen upon the oil starts the trouble It generates spontaneous or self-produced beat, and the temperature in the confined mass rises. slowly to the hurning point. Hours may pass before a piliar of smoke and fumes gives warning. So surely wal such a combination produce fire that one hastern insurance firm stages a regular demonstration of spontaneous combostion by placing only rags in a covered bucket. In three hours the list is lifted and tain rage are even burning.

As for the fire that started in a newspaper pile, just described, it was explained that printer's ink in the papers—aided, perhaps, by a little sulphur in the paper stock steelf had been the fire-causing agent. So rare is this occurrence that out one other similar case, in a private home, has been reported to the National Board of Fire I aderwriters. Even so, it advises against pling newspapers is a light,

unventilated heap

N THE food that event through Vermont not so long ago, beens were in-indated with water. Thirtly coough, several strange free that followed in the fount's make were traced to the wetting of the hay

One farmer's hay-filled barn near Muldlesex, Vt., caught fire two days after the flood had recoded. Heat generated in the set bottom layers of the hay pile had proch ced but drafts to the upper surface, and finally had uguited

the consequenced mass

Shipping larry feed composed of affalfa and molasses is a hazar lous housess, due to spontaneous combustion. Rollond experts are poweriess to prevent I and the only way to avoid burning up freig I care in to righ the stuff to its destination and appack it at noce hven at that, a car catches fire

In great coal piles occur some of the most troublesome cases of spontaneous combustion In one case a discarded Ulirishmus tree left on the coal pile of an Indiana public service company started a coal fire. A board fence started another, and wind-blown autumn leaves a third. Often coal fires start themselves; most coal piles have "hot spots" which, if they once attain a temperature of from 140 to 180 degrees. F are likely to mount rapidly to the hurning point unless discovered and the coal spread out to ecol.

SO DIFFICULT is a coal pile fire to extin-guals that the mand ingenious expedient is to make no attempt to put out the fire-but to load the burning coal on trucks and feed it at once into the factory builers to save what is left

of it for power!

To the present list of queer fires the future may add still others. There are today fives of more or less regular occurrence whose cause is still utter mystery. Within the last few mouths: strange blazes have occurred in Cuba, Indiana, and Louisiana sugar refineres. In each case, investigators found, they started in the center of bage of granulated ruger. Since sugar alone has long been on the "innocent list of substances supposedly incapable of spontaneous comhustion, the theory has been advanced and subsequently densed - that the sugar bags had previously been used for some such combustionaiding materia, as saltpeter, and not properly cleaned. The real cause is still unknown,

HOW much do you know about the weather? Turn to page 56 and see bow many of the questions you can answer correctly. Similar questions on various phases of knowledge, and their answers, appear each month in POPULAN. SCIENCE MONTHLY.





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(fundament from page 24)

pose to harness for the atom's destruction Vature's lightning stself*

I pon a mountain erag purposely chosen because of the frequency and violence of local thunderstorms, Doctors A Brasch, F Lange, and C. Urban, of Berlin University, have erected the diminutive "lightning-proof" cabin, sheathed with sheet metal. Overhead, across a chaim between the pinnacles of two lufty erags, they have suspended a mighty aerial 2,500 feet long. Its purpose is to trap the air's electricity during violent thunderstoring and harness it to destroy the atom.

Great "corona sheaths," weird-looking cylinders of guivanased stan more than two feet in diameter at some places on the antenna, prevent the currents from leaping in flaming bales from the wire. At the terminals of the cables, also, chains of thirty invulators such as are used singly on high-voltage transmission lines bar a sputtering flash to the mountain

A LREAD's from a small test aerial, the experimenters have drawn sparks lifteen feet long, indicating a potential of more than two million voits. During one thunderstorm such sparks occurred regularly, once every second, for half an hour Others flashed whenever a lightning holt passed overhead. Even is elear weather, electricity in the upper air supplied three to five thousand volts.

Now that the 2,300-foot antenna has been installed, the lightning-tamers expect that they will be able to harness current of from five to thirty millions of volts! As some indication of the forces they seek to control, the energy of a single lightning flash lasting but a fraction of a second, from a cloud a note high, is sufficient, it is estimated, to operate the enture subway system of New York City for a full hour'

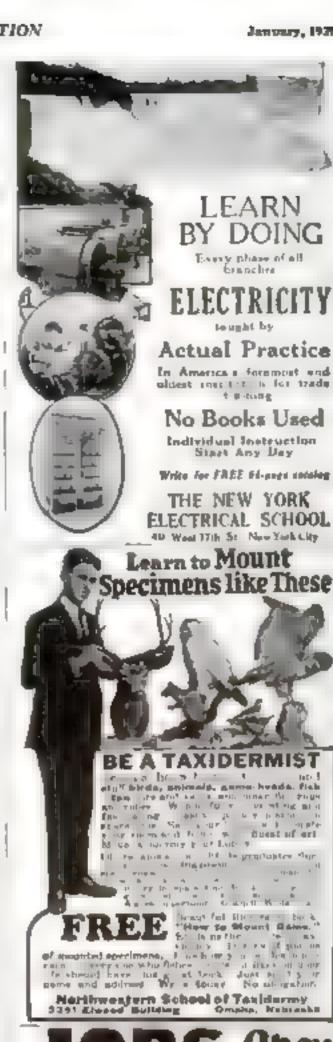
With suitable tubes to apply such a force in their sheet-metal laboratory, the German scientists, too, would smash the infinitesimal stom, the building block of which every tangible object you know is made—the word in your house, the clothes you wear, the very food you eat. Tiny? Magnify a drop of water to the size of the earth—and the atoms within it would be only the size of footballs. That is the clusive larget they mm at-and yet should they demoked it, the resulting upheaval might either wreck the laboratory and the experimenters with it, or confer incalculable become upon humanity

PERHAPS limitless stores of energy lie locked with the tray atom's shell, awaiting only its bursting to pour forth and run the world's machines. More fakely, the experimenter who blasts the atom to pieces may be the first practical alchemist. He may be able to turn silver into gold, and lead to iron, at will, simply by polvermag them in his atomic ment-chopper and fashioning new elements out of the plastic mass.

Of course, this at conjecture. No one kno surely, what may happen if the atom yields. Above all, it is the love of the unknown that hares experamenters to play with forces greater than any hitherto conceived forces whose appalling consequences can only be guessed.

So electricity, now, is again selected for the crucial test, but with new hope of success, by these modern delvers into the borderland of actence.

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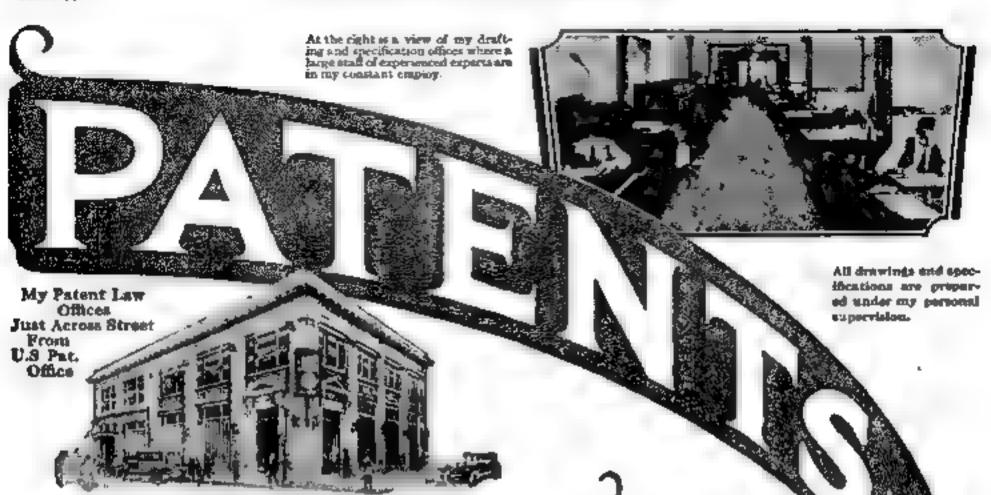




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Wonders of Neon

(Continued from page 47).

daylight scene Moreover, neon light is economical and considerably cheaper in operation than ordinary incatelescent lamps giving the same amount of allumination. Less than four percent of electric energy, it is said, is wasted in heat. Compare that with the highpower electric bulb in your home that borns your hand if you touch it while it is lit! Transformers supplied with the ugus convert ordinary lighting current into the 8,000 to 10,000-yell current used to operate the cool pron tubes.

Amplane beacons use neon light extensively because orange-red light, such as neon provides, is peculiarly well able to penetrate fog-Stationary installations of great neon-filled tubes atop towers and office buildings guide passing planes; other types of bearons are revolving searchlights with a compact aron hight providing the beam. Often aron beacons can be seen for len or twenty miles through hase when other lights are invisible.

ONE novel type of air bracon recently exhibited uses as its light source a small hollow glass buth, filled with penn, and devoid of any electric connections whatever bulb, however, rests within a spiral electric coil. High-frequency currents, pulsing through the coil, supply mittolike energy that lights the gas within. It will be remembered that in a demonstration of abort, high-power radio where the electric voltage was the greatest. in the air by lighting, without any visible con-

Turky neon is used in each a variety of castruments as high voltage aniheaturs, lightning arresters, and ignition gages. Fred, A. A. Fleming, of London, was the first to use neon in tubes to detect radio waves; now it serves no also in photo-electric or light-armitive cells, and in television receivers.

A neon lump can light to full brilliancy and go out completely in a stilliouth part of a second. That explains the preuliar utility of a neon "glow tube" for furnishing the light in a modern television receiver where, to build up a composite parture of thousands of dots of light, the tube must alternately light and extragrash riself many thousands of times each recentral.

WHAT further uses will be discovered for neon? One startling possibility is that near lamps may light tomorrow's homes. Some experts believe that present taugstenfilament lamps, improved as they are over the old-style carbon-filament type, are not the hast word in efficiency. Perhaps the next great step forward will be filamentless, glowing tube-shaped lamps patterned after the peop selvertising signs, and giving tinted instead of white light.

"such a hump," explains Dr. D. Maefarlane Moore, Edison Lamp Works engineer and inventor of the Moore hamp widely used in television receivers, 'is particularly efficient be-cause practically its entire radiation is of a monochromatic, or one-color, nort. With the determination of a single color best suited of all to reading or working, a lamp for the home might conceivably be designed to give light of this color alone and waste no energy in other kinds of radiation.

Yellow light, for matance, might serve best. It is unlikely that the red of neon alone would be sustable in the home, but this color might be modified by other substances. Of course happe of the filamentican type would require special wiring to provide their high-voltage

Once a necless rarity - now a precious, valued substance with new uses looking about to add to its already varied ones that is the story of neon, newcomer to andustry.



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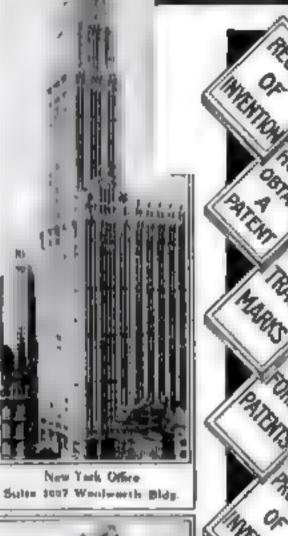
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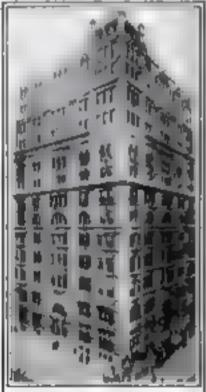
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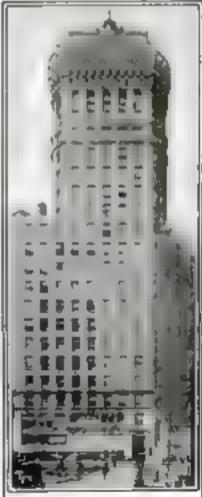
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Shoots His Racing Car. at a Target

(Centsnord from page 22)

design for the new cur? So the seaplane was recast, so far as outward appearances go, into a land atachine designed to house the Napier aerial engine. Irving and his assistants developed the streamline idea until the new carwas given a frontal area of just over twelve square feet

A model of the car was at first constructed, in weret, and wind resistance tested in a tunnel. The model was tested again and again for speed, ability to hold to the course, and general safety. Segrave had previously instrued with his Susbeam that a cur traveling at a speed of 200 miles an hour or more in best controlled from the center. His incastrements were taken and his sout built at the exact center line.

THE Napier 200-humepower engine rotates at 3,400 revolutions a minute, and the frame is braced with steel tubes of the utmost strength. The steering gear controls the front wheels through a separate mechanism for each. In all, the cur weighs five thousand pounds.

The tires are the result of special laboratory research. The probable speed of wheels in the Daytona trade, as Segrave forces the speed up to four miles a munute, will be about 2,500 revolutions a minute. The tire size which was finally decided upon is therty-seven inches by eeven inches

The cur stands only three feet nine inches high; twenty-six feet long, and six feet four inches wide at its widest part. It has a seven-inch ground clearance. The Namer engine is twelve-evlindered, the cylinders spreading fanwase in three rows of four cylinders each. The valve in the bend idea is used, with six overhead cam shafts. The hore is five and a half inches the stroke five and one eighth inches. With these specifications the Napier engine carried Flight Licutement Webster at a recoroled speed of 981.5 miles an hour is the S-5 at Vensee In the feets the S-5 flow at the tremendous speed of more than three himdred miles an hour

So much for the motor car that is expected to traverse a mole in fifteen reconds. Men can produce such an annihilator of space, but can man make it do his building, and live to discass has experience? The deviation of one small muscle, the failure or latity of a composited system of busines nerves, and the result is almost sure disaster.

NO ONE appreciates the human equation in such a lest better than Segrave, who was carried along the made before at 200 miles. an hour. His job, as the wheels of his eactouch the start of the flying mile, in conceptration such as few men are called upon to give. The eye must remain fixed on its goal, nevet deviating never blinking.

So Segrave has equipped the new car with rifle sights which will be aimed at a target at the end of the course. This target, an enormous bull's-eye, will be suspended from a wire, strung between two poles or towers thirty feet high. At the front of the hood is set the front sight -the bead of the rifle. The back night, a telescopic arrangement similar to those on but game guns, is set immediately in front of Segrave. A black hand painted on the hood connects the two aights.

he he starts, Segrave will set his sights on the bull's-eye, open his throttle, and with his eve hugging the sight, fire his golden yellow car at the turget. As he nears his goal, if he ever does, the target will disappear, for it will bang in the air tharty feet above his line of venous but almost instantly after it but disappeared, he will have crossed the line. The abot will be fired.

Will Segrave aim straight?

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Your First Television Set

(Continued from page 65)

it, reverse the scanning disk and also reverse the direction of rotation of the motor.

There is also the possibility that the image may be reversed. In other words, it will look like the negative film from which prints are made instead of like the print. To get rid of this trouble reverse the waves leading from the radio receiver. Once you have the right combination of dock face and motor rotation for any particular television broadcasting station, you will not have to make any further changes untal a change is made in the broadcast appa-

A SSUMING that you have the neon tabe glowing properly and the disk rotating at just a trifle faster than the required speed, you are ready to receive television images.

Of course the ratio receiver must be tuned to the station from which the television broadcasting is to come and you must leave the double-pule, double-throw switch set as that the loudspeaker is connected to the set.

The approunces at the stating will make a preliminary announcement which usually inrlades a statement of what is to be televised. Most of the time this will be a close-up view of a man a face and the subject will smale, laugh, amoke a cigarette or otherwise indicate animated but relatively slow motion. It also is common practice, at some time during the television broadensting, to hold in front of the transmitter a large call-letters sign.

Of course you will be able to tell when the man's face is upside down, but it is difficult to determine whether it is wrong side to. The letters of the sign will reveal this error

As soon as the lesevoion signals start, throw the switch enusceting the radio recover to the neen tube. The tube will flicker quite visibly If you cut a photograph into this horizontal strips and then put the photograph together again, with each strip moved along a fraction of an anch. the whole picture would appear learing in one detection, and if you moved the strips too far along the porture would disappear in a meaningless jumble of light and dark areas. This is precisely what happens when the scanning dock departs from the correct

Because television is still in the experimental. stage, it is not practical to publish a list of the stations engaged in television broadcasting, but if you desire information on this point or on any of the apparatus used for the work, uddress your letters: Technical Editor, Populan Science Mostraly, 250 Fourth Ave-

nue, New York City.

Our A. C. Set Completed

(Continued from prign 83,

and a 171 A tube in mocket G4. Then insert the plug of the A-power transformer in the wall socket. In fifteen to furty-five seconds the detector tube, type 227, will heat to operating temperature and you can tune the set.

Screw in the knob on F? until the set is in oscillation, and then turn the condenser tuning knob until you hear a whistle that marks the wave from a broadcasting station. With the rotor plates of D4 loosened, and the plates of Do about one quarter engaged, adjust the disl and the rotor of D4 until the signal is as loud as possible. Then tighten the rotor set screws. If you are troubled with oscillation or squealing, even with the knob of F# all the way out, adjust the oscillation controller H.

When you wish to tune the short waves, pull the tube out of socket Of and transfer the antenna wire from the binding post to which it is attached in Fig. 2, over to the nearest similar binding post on the mounting that holds A1, B1, C1. Then plug in the coil that covers the wave band you denre to receive.

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A definite program for detting ahead findertially will be found on page four of this tends.

Battles with Polar Ice

(Continued from page 2)

north, east, and west of you." And the ship fettered with chains of ice! Another radio flash! But not from Batteshkin. It was the Armona sending word that it had gotten through to the morth court of Sprinbergen and soon would enter the ice

The next day everything around the ohip middenly creaked and mared! What was the matter? The ice fields surrounding the boat, as far as the eye could reach, were moving in different directions.

Ice-anchors and hawners were distodged. Huge masses of see clowled over the Matypia, broke to pieces, plunged into the water, and emerged again. Now open water appeared around the host, and as soridealy disappeared. Within the ship, cross beams best and cabin doors warped. Filler and point flow off the walls in chanks. The see-breaker was like a house in an corthquake.

ABOUT moon the wind neathered the fog, and Hope Island was against only five miles away from the shap!

Now the moving see carried the boat straight against the island-a new danger.

The engines raced madly, full speed about? At first, the too refused to yield. For half as hour the skip faded to advance a single vari. Then the frame wall legan to separate slowly? Phousing on desperately the Matagan pushed through Water spouled in general from he neath the arrow and whilpeads seethed all around. Have several variate long and note were quickly pulled in and rate to the surface, broken to but. The blades of the seres struck the we cakes with continual crashes.

reall, no word from the aviators. In the afternion of the fourth day, the ship was bemined in again. Whole mountains of fee piled up against the order. That might, a loose win I rose from the porth and drove the ship shorly toward a group of scelergs. They faced the Malynn like stolid marble mounters. They seemed no chance to avoid them. Again a terrific see jam made the engines useless.

The crew was on deck. Not a word was spoken. With sungled fear and awe they watched the magnificent agist before them

BIT the field see which shorty propelled the Malpyon happily passed between the scelergy. The fearful danger passed. At last the Malpyon came to a full stop four miles from the grande pland that had threatened it with destruction. There it lay, see-lacked again, for two more days. And stall no word from the fivers.

At last, in the dawn of July fronth, while must of the even were askep and only the cuptain and belianman were on the bridge, a small black spot appeared in the distant sky. It was the plane! Hatsishkin and his men bad suffered untild hardships. For days they had scarcely slept now enten, and several times had excaped death by a narrow margin.

These experiences consinced the leaders of the experition that the Margan's reade about the changes. The ship was braded anothward to open water and then east, where less ice was expected. Many another hard bettle with for and does was fought, until finally used came from the Acases by racio that the Italian some had been reward.

The superb achievement of the Arassa, and later the thrilling story of the Malgren e adventures, have brought the see-breaker a measure of public remove. The fact that boats of this type, during the last half century, have virtually built up a new technique of the un ill still, however, little recognised.

For thirty-nine years, the great wonden ser-breaker, the Bour, of the L. S. Count. Guard, was Uncle Same policeman as well as the only physician, the only hospital, and the only hosp of food supply north of Noone,

Alaska. Some two years ago the veteran ice fighter was succeeded by the modern steel cutter, Northland

Canada, too, uses ice-breakers on the Great Lakes and in the Gulf of St. Lawrence, where four of the ships are on the job each winter. The Mitton, which clears the way for shipping in the St. Lawrence, is one of the largest icebreakers affant.

Not only in purpose, but also in design, the ice-breaker is different from every other type of craft affort. It must be both heavy and powerful. Capable of spred sufficient to give it the necessary momentum to break the lee by the above force of its blows, it must at the same time be strong enough to inflict, and not suffer damage by the collision. It must be able to crack see into pieces weighing a few score tons apiece! And at the same time, it must be capable of alphage on the see

The majority of new-herekers are equipped with large enter tanks free and oft and in the center. These may be filled or emptiod at the rate of several hundred tons as hour, so that the weight can be greatly increased to smash the ica, or to roll the ship in such a manner that it can amash itself free. The ships are provided with steel plating of armor thickness, which sometimes is even doubled fore and all along the water line and to the bottom of the level in the fore body, where the ice impact is heaviest.

Today, ten-breakers capable of crushing their way through ore from five to theiry fret thick go to the reactio of ships in distrem in all parts of the world. They may human life and costly craft, and are an invaluable and in increasing humanity's knowledge and wealth.

How to Test Antifreeze

(Centered from page #4)

to learnt the hydrometer in the radiator at any time to determine the strength of the solution."

"Not any time," answered Gus. "You forget that a hot solution is expanded and the hydrometer will sink down below where it ought to float. That reading is only good at about staly degrees."

"Would that reading also apply to that are autilizene, ethylene glycul." Deuter asked.

I should my not replied tom completically "It a good only for a maxture of giverna and water. Ethylene given in just as good as giverns as an antiferent but the pure stuff reads only I 100, so you'll have to use a bydecemeter that reads lower than the storage battery by-drometer to test it when it's thinned with water. Plans water reads 1,000 on the hydrometer scale, you know.

"And if it's alcohol you're trying to test, you'll have to have a hydrometer that reads even below that, because alcohol is lighter

then water."

"If giverin and ethyless given do not evaporate as does alcohol, I suppose there's no necessity for testing quite frequently as is the case if you are using alcohol," Dexter observed.

"Depends a lot on how but your motor rans," Gus explained. "If you don't go spraying the road with expensive cooling solution through a leak, or by boding it over an you did, and the motor doesn't run so but that it evaporates a lot of water, you can just squart in the radiator once in a while to make sure that the solution is still there.

"Either glycerin or ethylcae glycol will last almost forever if you don't loss 'em through leaks. There's no reason in the world why you shouldn't use the same solution winter after wrater, adding a little autifreese each year to make up for leaks if the hydrouseter

tells you it's needed."



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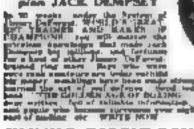
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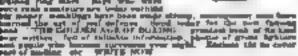
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Magie Tricks Explained

(Continued from page 4)

early, and by placing one end against the floor, and the other against the lid of the hox, force the fid off slowly and nonelessly. The performer escapes and pushes the tails back into the holes. It appears, to the audience, as if he had made a miraculous escape through a knot hole in the hou

blave you ever seen a magnetan product a basket of flowers from an empty cone* The flowers are artificial, of course, and so eleverty made that they fold flat. Severa bundred exough to fill a bushel basket—can be concraled, or "palmed," in the hand. When they are released by dropping them into the cone, they metantly upon and swell out, overflowing the coor in illustration on page forty-us shows how these flowers are constructed, with given tusue nuter leaves, varioulared inner petals, and a small purpe of thin watch-spring etrel that causes them to open and spread out. When released

ACLEVER trick, depending entirely upon an ingenious mechanical principle, in known as "The Duck Tule." This is a large metal tub, which the magician fills with water after showing that it is apparently empty. A few wooden duck eggs are dropped into the water, a shot is fired, and three or four durks ewise to the surface of the water and jump from the Lub'

The tub has a false hottom, consisting of two wide rotatable hindes made like electric fan bludes except that they are flat. One blade is turned by means of a rupe that passes out beband a curtain. When the blades are closed, that m, when they are so turned that no opening is visible between them. the water can be poured cate the tab without filling the bottom half to this lower compartment the live ducks are placed. When the tupe is pulled, revolving the blades, the ducks can escape to the surface of the water

Any story of stage magerians would be incomplete without explaining at least one of the "effects" produced by so-called East Indian fakes, and occumulately reported by eventlous militaries do i miracislous. Il is true that m Inducese see many starturg, unless which feats performed; unfortunately, however, these become enaggerated in story on reacting our shores, so that one must take these auracles with at least a hump of salt. It is a agnificant fact that Housing was able to duplicate many of the feats of the fakers without meribing the cause to anything more mystical than plans trickery and a knowledge of service and mechanics.

SEVERAL well-known East Indian faxus are meeting with success in vandeville with what they call the "buried alive" test. The performer is sealed in a casket, which is buried in a mound of sand or placed on display in full view of the spectators for a certain length. of time. The fact that the easiet or box is scaled prevents any outside air entering.

Here again the performer falls buck on according means. He carries has air, in "canned" form, into the casket with him Several manufacturers produce, for the use of the medical and destal profession, tiny steel drams containing surprising amounts of air in compressed, liquid form. These drams contaux sufferent oxygen to keep one alive for a considerable time. They are small enough so that an angenious performer may conceal several next his body even when dressed in a bathing suit. It is merely accessary to open them slightly, and a supply of fresh, life-grying unygen continually fills the custet. On the expansion of the period and before the casket. has been opened, the performer again concents the contamers, and steps out of the casket before witnesses who occursibly promounce the barasing experiment "genuor



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financially will be found on page four

of this issue.

Must We All Wear Glasses?

(Continued from page 31)

slightly from time to time so that objects at sufferent distances can be seen.

Proof that this is so was obtained years ago by a popeyed scientist named I burnas I oung, whose eyes had the advantage of sticking out so far that when one of them was turned inward toward his bose it was possible to get a semicircular metal fork, like a miniature pitchfork, in behind it to hold the back of the eyehall rigid. Another fork was then backed up against the eye in front, holding the cyclosil tightly between the two. Had changes of focus between near objects and far been accompanied by shortening of lengthening of the cyclosil, the clamped eye would have disclosed them. None were found.

What reasy happens when the focusing is done is that muscles mode the eye pull against the edge of the less like firemen on a rescue net. This fattens the less and makes its focus longer. When the muscles relat the cluster less aprings back to its former shape, shortening its focus.

THE ability of one's eye lenses to do this quickly and accurately: the technical name for it is accommodation—is not only an essential for doing time eye work without glasses, but it is probably the best of all measures of youth, not merely of youth is years, but of real vigor and "physiosogic youth" of the body. Faces may be lifted or writakles out out. Nothing will had the tell-tair age marks in the eye's forming ability.

The lenses of young propies are soft and claric. The massies that stretch them have an easy task. When the tensors reases the lens thickens instantly. Age causes a sing hardening of these senses. The massies rannot change them so easily. That is why propie who are one in years, or people whom disease or unhealthful living has made old before their time, have so sench difficulty in focusing their eyes for different distances; a difficulty relieved in part by the modern invention of beforal glasses.

The practical difficulties with precise focusing which account for so many deficiencies of modern eyes begin with this matter of a tradency to focus too close or two far off.

Something that many mothers do not know at that practically all young bulies are far-aighted, like very old men but for a different reason. When a baby is hors the eye-ball usually has not made its full growth. It is still too abort for its lens system, as though a camera maker had left the box of his camera as inch or two too short. A buby probably sees nothing clearly unless it is at least several feet away. As weeks pass the cycluil lengthens and the focus gradually comes to be normal, so that changes which the muscles make in the flatness or roundaries of the lens are able to bring anything into focus. Then for the first time a baby nees clearly his own feet or hands.

hometames this normal lengthening of the haby a eyehall after birth goes too far and causes one of the eve troubles most feared by students of our national evengat, the meanaghtedoom of school chatters.

Another possible trouble with eve focus is dispincement on one sale or the other, like a camera the front of which is bent or pushed to one site. A spectacular instance is the recently reported case of Joseph Rockwitch, of East Ratherford, N. J., a curpenter whose eyes persuaded hun to cut off his thumb.

One day Rockwitch unaccountably missed a lath three times in succession with his hatchet. He went to the door for a breath of fresh air, came back and assert emother blow. This time the lath was still safe but an inch of his thumb was gone. A doctor served it on again and it

grew fast, but the incident required investigation. The trouble, flockwatch a oculast found, was with his eyes. Now he belongs to the spectacled brigade; his glasses bringing his eyes back to normal from their focusing point a few inches on one sale.

MOST important of the defects of eye focus, because communent among people of youth and early middle age, are the blurring and industractness due to a third kind of eye defect, called artignatium. Buch eyes really have a find of communation of nearegitainess and faringhtedness. They are faringhted on two opposite sides and nearegited on the other two.

This explains why astigmation is tested with the familiar wagon-wheel chart, its black lines rushing in different directions accous a circle, like the spokes. To an astigmatic eye only one of those spokes, perhaps in one direction, perhaps in another, will be sharply in focus. The one perpendicular to this one will be badly out of focus. The one that is in focus looks black because its image on the erholive relina of the eye is a sharp one. All the others look gray because their images are blurred.

Perhaps this blarring, which is what always happens when anything that you are trying to see is a little out of forus, might do little harm for most kinds of work, were it not that the eye is always trying to do its best. Its tmy herves and muscles keep continuous reaching the lens in an impossible effort to get exervithing right. Furthermore, close concentration on fine eye work makes these muscles hold the lens and the entire eyebal, for a long time at a definite forus, nimething easy enough for the nerviews brain tubes and steel acrews of a microscope, but exceedingly timing for the mobile muscle fibers of the eye,

This tensity required by a fixed focus is probably the chief cause of eyestram. That is why your eyes seem rested if you can look away from your work once in a while, out of a distant window or at some other object requiring no close focus and no fixed one. That is also the reason for the lessened strain and better productivity of the workers found in the Luglish experiment, where everybody a eyes had been adjusted by glassos no that the natural focus of each eye, when relaxed, was the made as the distance of the work.

i adoubtedly such fixing of the distance of the work to sort the natural focus of the worker's relaxed eye, whother done by special glasses, as in the Euglish experiment, or by seljusting the mutual positions of work and worker, would remove much of the eyestrum of so many modern jobs. Higher or lower chairs for desk workers, for example, are usually easy to provide and are often useful. Also, it is often possible to give the overwilling focusing muscles rest by occasional changes of work during the day, shifting the necessary eye focus from near to far or allowing periods when no precise focus is necessary. Another procedure ctumes beneficial to the oyestrained individual is eye gymnastics, exercises prescribed by the oculist to suit each individual's eyes and to train their muscles for the particular kind of work they need to do.

But foremost of all the eyestrain remedies that science can suggest for factories, offices, or homes, at better light and more of it.

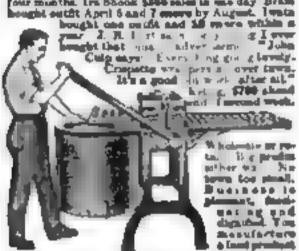
Brighter lighting will not care absolutely all the alls of everybody's eyes. Oculists and glasses would still be necessary if everybody worked in open daylight and had it twenty-four hours a day. But if more attention were paid to plenty of light in offices, workrooms, and rustes where people read type, fewer of us would be wraring glasses and the British suggestion of a pair of spectacles for every work, man would be only a remote possibility.

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Description of the party of the

Lost Races Live Again

(Combined from page 4)

Christian Imos, year for year, day for day and even hour for hour, was worked out only last

Linking the Mayon and Christian calendars back to 600 m. c. with the possible error of about a month, Dr. Sylvanus G. Morley, of the Carnegie Institution of Washington, D. C., predicted in 1922 that the error could be climinated by resorting to astronomy

His prediction came true. Dr. Herbert J. punden, professor of anthropology at Harvard University, by studying the phases of the planet Yeuss, which were used by the Mayas for time-fixing purposes, finally wound up the "Mayan Calendar Case" exactly sixty-three years after it was first propounded

But the detective of archeology does not always succeed in making a capture'

AFTER months of toil Cevil Firth, noted British Egyptologist in charge of excavations at Sakkarn, Egypt, last May gained entrance to the toosb in which it was supposed that King Zover, builder of the famous "step." pyramid, was bursed. He found a bollow caveva, in which King Zover was completious by his absence. Another Egyptologist two years ago found the tomb of Queen Hetepheres, mother of Cheops, builder of the great pyramid but its serrophagus was empty.

But often, fortunately, the archeologist's shrewd and patient work is crowned either with the discovery of tangible treasure or of a truth that increases the aum of man's knowledge about himself and his fascinating past

Through the use of calendars in the form of tree rings, the secret of the age of Puchlo-Bonita in Arisuna was bared not long ago in one of the most delicately drawn schemes ever to delight the acjentatic world

THIs was the question. How long ago did an Indian people ave in the big prehistoric anartured house in Armena, Log supports found in the name gave Dr. New M. Judd. director of the National Geograpisms. Somety a Pueblo Hondo expedition from 1921 to 1926 a. heiliant sies. If he could match rings of the less cross-sections with other lugs of known dating he might fix the age. In recubiration with Dr. A. 2. Doughou, another distinguished member of the same exploration part he traced back the tree calendar through the oldest living trees, and then through the crossnections of logs in modern pueblos which had been inlyaged by the Indians from brokendown spanish missions. The investigation duringing at times, stretched over a person of air years, but the time is now in sight when it at last may yield the exact year, some ten centuries ago, when the last of the Bonitans fied from their monumental commune home.

In and out of books, on the stage and off, the detectors appealing of infling the evidence When he does to, his teraturag as, of course, figurative. But the archeologist literally softs'

More than 100,000 tons of mad and rock from the runs at Pueblo Bonita were put through the seve. Howard Carter, the Ameroran archeologist and Lord Carnaryon moved débris shovel by shovel for aixteen years before the encient Egyptum tomb of Tut-ankh-Amen finally appeared in all its splendor!

The archeological detectives put through sereess mounds that once were Ur, one of the med important of the early Babylonian cities, and Nineven, the renowned ancient capital of the Assyman Empur, both well known to studeats of the Beble. Their labors were rewarded by desizing collections of currends, gold bonds, carried every, and count.

Task about mystery and thrille! In there a keener finer thrill thus that which comes with the solution of rusiles from the earlyest past-riddles that have balled the greatest intellects for conturned?

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Here Are Correct Answers to Ouestions on Page 56

L The formiess, foggy clouds known to "stratus" may float as bigh above sea level as 5,000 feet. Cumulus clouds, that look like masses of cotton wool, average from 4,500 to 6,000 feet high. Cirrus clouds, those molated feathery white clouds, average 27,000 feet above the earth.

2. The cyclone is a disk of air about 1,000 miles an diameter that sevotee horizontails. The hurricane is a evelone of smaller area with considerably greater voctical action, which makes at more destructive. The tornado is a revolving mass of air approximately 1000 yards in diameter, which because of its furnous vortical motion is extremely destructive.

3. When the air is clear and relatively low in generature constent bindes of grass, stones, and other objects richate their heat at night faster. than beat is radiated to them by the surrounding still air. The temperature of these objects therefore falls below freezing and the monture in the air congeals into frust on the surfaces of the objects.

4. Dust particles in the air scatter and diffuse light rays, but the effect is more pronounced on the variet, blue, green, and other redors than it is on red. Thus when the our is dry and no moisture forms to become the effect of dust particles, the sky will book red at mindown, because the dust particles diffuse the other rays and let the red light from the clouds come turough to your eyes.

5. Rain is produced by the condensation of water vapor out of the atmosphere on the countless thousands of dust particles always Boating in the air. This constensation can occur. only when the air is couled below the dew posht. Warm must set couls as it tues and expands. When the temperature drops below the lew point aignify enough drops of water will form, heavy enough to fall as rain.

6. When light strikes a transparent sphere such as a rausdrop, part of it is reflected from the surface and the rest penetrates the surface and is refracted. The refraction spreads the ight into its component rolors, which you see in the form of a brunant rainbow

7. The lines on a weather map are drawn through points where the atmospheric prestures are equal. They are casted suchars By studying them you can determine the air pressure at various parts of the earth surface, and also predict the probable direction of the wind.

 The barometer is an instrument that measures atmospheric pressure. A steady rise usually indicates settled fair weather. A slow rise forecasts dry weather with plenty of wind, while a rapid rise indicates clear weather with high winds. A falling barometer indicates wet weather, and if the full is rapid you may expect wet weather or high winds or both.

9. Halos or rings around either the sun or moon are caused by the refraction of light by enormous numbers of tiny crystals of ice formed high in the upper air

10. A hygrometer is an instrument that detempines the relative amount of unter vapor contained in the air, or "relative bumidity There are reveral varieties, the most common being the wet-and-dry-bulb type. Two ther-mometers are mounted safe by side. The bulb of one presponed to the aut, while the other pr covered with fabric kept wet with water from a vewel below. The evaporation of this water gools the fabric covered built more than the dry one, so that the thermometers read differently Since the rate of evaporation depends on the amount of mousture already in the air, the difference in the reading determines the relative



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How to Build a Fireplace

(Continued from page 81)

danger and structural damage through unequal settlement or movement between wood and masoury. In plastering a fireplace or chimney, metal lath is prescribed.

If concrete or field stone is used in constructing your fireplace, a greater thickness of walls is needed than with brick, which is first in ability to withstand heat. Concrete tends to crumble and stones crack with high temperature. These difficulties are overcome to a degree by massive construction, which absorbs surplus heat and allows for interior surface wear. Where the allowable thickness of brick in a fireplace is eight inches, concrete should be twelve inches and stone or rubble masonry sixteen inches. Again, for the chimney above fireplace the flue lining may be cased with a single course of bricks laid flat, but concrete blocks should be thicker or contain metal reinforcement. If the chimney is cast concrete it may be of one brick thickness but needs reinforcement both vertically and horisontally.

CONCRETE will make an effective hearth because of its mass and its insulation from excess heat by sahes. It is commonly used as a base for a top course of fancy bricks with a so-called trimmer arch of brick as the support below. It is feasible to have a reinforced concrete slab, dispensing with arch and brick surface. The concrete top may be marked and colored in brick effect, color being added to the mortar. We must not forget to install an ash dump in the inner hearth, that is, a metal tip-up door that is opened with a poker and lets ashes fall into a pit below. Nor should we take it for granted that the chimney base is always what it should be. The concrete foundations should be at least a foot deep and a foot wider all around than the masonry above. If the chimney is outside the house, foundations must extend below the frost line.

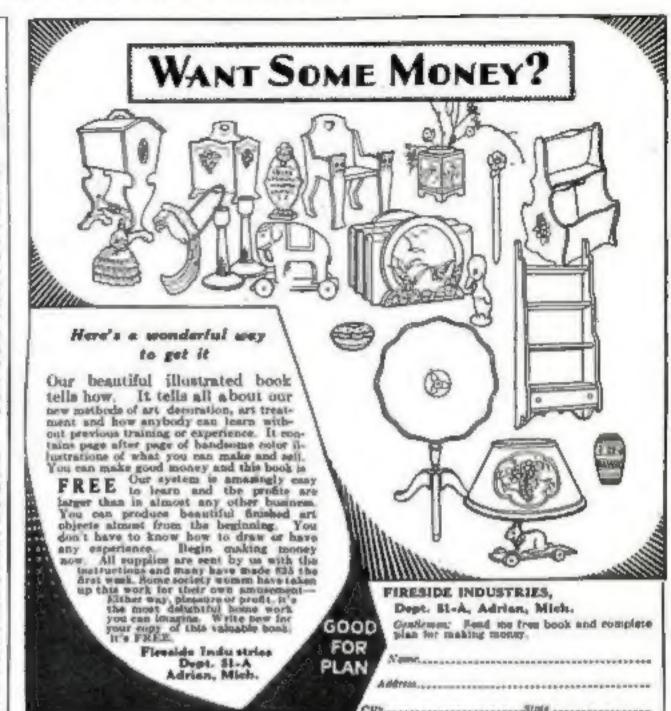
Your fireplace and your chimney are a unit, each so dependent on the other that all the smoky troubles below may be cured by fixing the exit above. A perfect fireplace will misbehave if the chimney top is subjected to down draft by a high ridge or even an overhanging tree. The exit should be not less than three feet above a flat roof or two feet above any ridge or other roof summit. It is also inadvisable to use any sort of chimney bood, especially a kind that reduces the flue area. Hoods of metal and terra cotta seem to be stylish at the present time, but the laws of Nature do not recognise style.

The fireplace screen of course should be large enough to cover the entire opening. Otherwise sparks from a wood fire may fly into the room and cause serious damage. If the mantel is wood it is better to install it at least a foot above the opening.

A ROARING fire is bazardous in the average house. When long flames belch up the chimney from a mass of paper, excelsior, and kindling wood, they may ignite soot within the flue with a discharge of red-hot einders on the roof. A shingle roof may eatch fire, and aside from this danger the flue lining may crack from sudden precasive heat. The chimney should be cleaned every year or two. The modern way is to call up the vacuum cleaner man who comes around with a power machine, long hose, and ladders. He extracts the soot from all flues with neatness and dispatch.

The Patent Office has plenty of inventions to increase the efficiency of fireplaces, but their ultimate value is doubtful. When a fireplace is perfected to the limit it remains a pleasant auxiliary in the battle against cold and not a substitute for a regular house-heating system.

Give me an ordinary fireplace of enduring masonry, something that is very wasteful of fuel, but very comfortable and cheering in mildly cold weather.



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